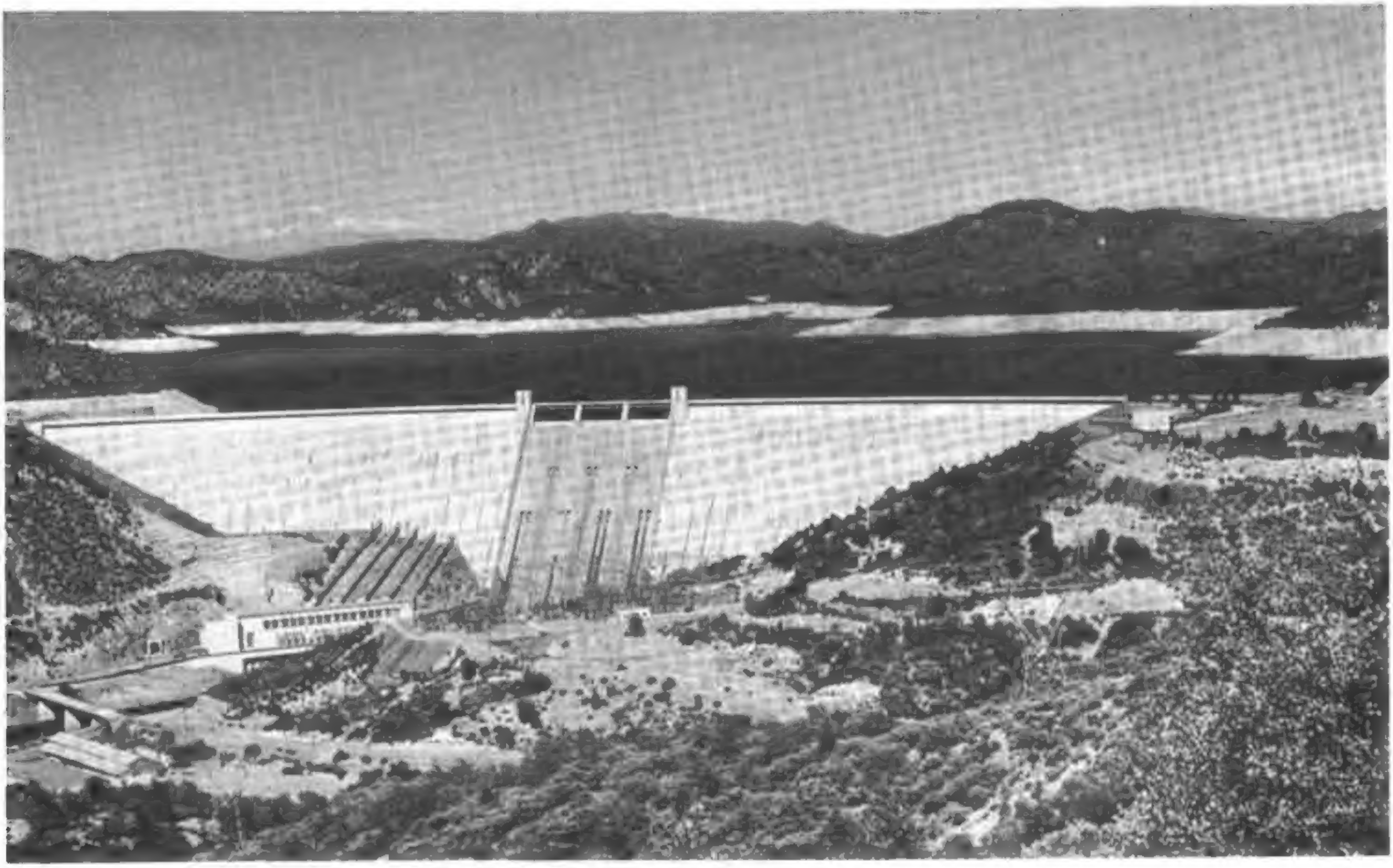
SOIL SURVEY OF

Shasta County Area, California



United States Department of Agriculture
Soil Conservation Service and Forest Service

In cooperation with
University of California Agricultural Experiment Station

Issued August 1974

Major fieldwork for this soil survey was done in the period 1958–65. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in the publication refer to conditions in the area in 1967. This survey was made cooperatively by the University of California Agricultural Experiment Station, the U.S. Forest Service, the State of California, Division of Forestry, and the Soil Conservation Service. It is part of the technical assistance furnished to the Western Shasta Resource Conservation Distric.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of the Shasta County Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the area in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described, gives the Storie index rating for each soil, and gives the page for the woodland group, range site, and wildlife group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, range sites, and woodland groups.

Foresters and others can refer to the section "Woodland Uses of the Soils," where the soils of the survey area are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Ranchers and others can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in the Shasta County Area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the Shasta County Area given at the beginning of the publication and in the section "General Nature of the Area."

Cover: Shasta Dam and Shasta Reservoir. This is a multipurpose dam that provides flood control, electric power, and water for irrigation, domestic use, and recreation for much of the northern part of California.

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Contents

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SOIL SURVEY OF THE SHASTA COUNTY AREA, CALIFORNIA

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UNITED STATES DEPARTMENT OF AGRICULTURE AND THE UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION [1]

SHASTA COUNTY AREA is at the extreme northern tip of the Central Valley of California (fig. 1). Redding, the largest city in the Shasta County Area, is located where the Sacramento River abruptly leaves its mountain canyon and begins to form a rich alluvial flood plain. Surrounding this strip of bottom land along the Sacramento River are parts of three mountain ranges: the California Coast Range to the southwest, the Klamath Range to the northwest, and the Cascade Range to the east.

Shasta County Area is in the southwestern part of Shasta County. Its total extent is 1,035,000 acres. It is bounded on the south by Tehama County, on the west by Trinity County, on the north by the Shasta National Forest, and on the east by the Lassen National Forest. Shasta County Area includes all of the private lands in the Western Shasta County Resource Conservation District that are south of Shasta Dam. Elevation ranges from 360 feet at the mouth of Cottonwood Creek to 7,000 feet in the mountains near the eastern boundary of the survey area.

About two-thirds of Shasta County Area is in range, noncommercial timber, or brush; one-third is in commercial timber; and approximately 33,780 acres, or 3 percent, is in irrigated crops. Mining was formerly the most important activity. The growing and harvesting of trees and the manufacture of wood products are presently the most important industry. Livestock and livestock products account for more than half of the income derived from farming, and field crops account for about one-third. Recreation is also important.

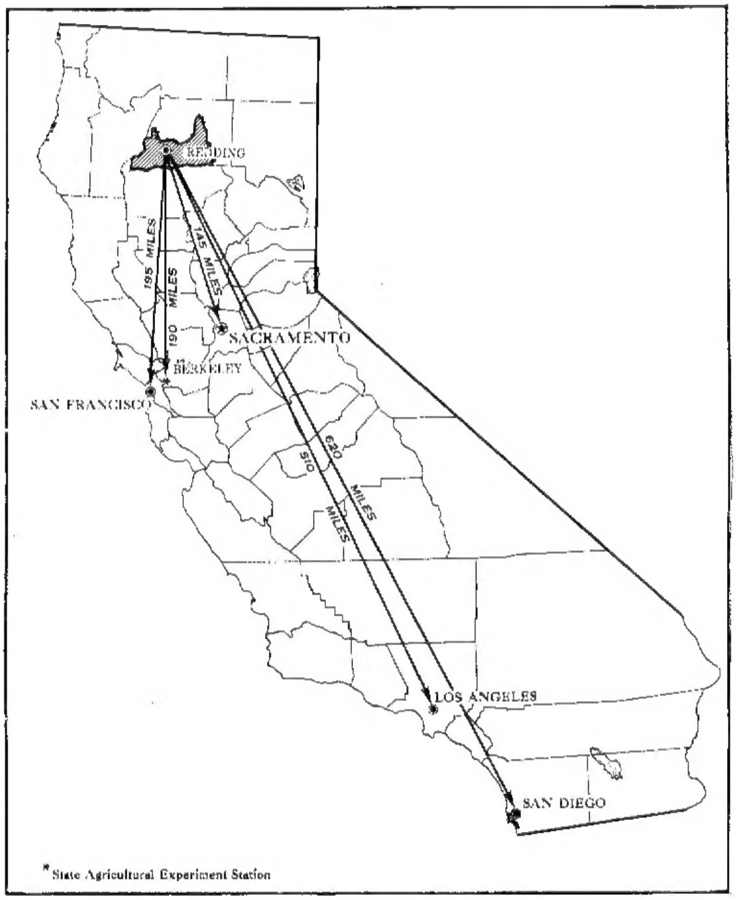

Figure 1.—**Location of the Shasta County Area in California.**

How This Survey Was Made

Soil scientists made this survey to learn what kind of soils are in the Shasta County Area, where they are located, and how they can be used. The soil scientists went into the survey area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles

[1] Upland parts of Shasta County were mapped by the State Cooperative Soil-Vegetation Survey. This was a cooperative undertaking of the California Division of Forestry, the Pacific Southwest Forest and Range Experiment Station of the U.S. Forest Service, and the University of California.

they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Redding and Tehama, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Aiken loam, 0 to 8 percent slopes, is one of several phases within the Aiken series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of the Shasta County Area: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. An example is Inks-Pentz complex, 5 to 30 percent slopes.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Lyonsville and Jiggs soils, 50 to 70 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Cobbly alluvial land is a land type in the survey area.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Shasta County Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The Shasta County Area is in the northern part of California. Based on physiography, there are three major parts. These are (1) the mountains, (2) the foothills, and (3) the terraces, valley bottoms, and flood plains. One or more soil associations are in each part. The soil associations have been grouped mainly on the basis of soil differences that are related to their physiographic features and to differences in parent rock.

The 12 soil associations in the survey area are described in the following pages. The terms for texture used in the title for each association apply to soil material below the surface layer. For example, in the title for association 1,

the words "very gravelly or very cobbly sandy loams and loams to gravelly and very cobbly clay loams" refer to texture of the soil material below the surface layer.

Soils of Mountains

Soils of this group are on mountains in the western and eastern parts of the survey area. The mountains are deeply entrenched by streams flowing into the Sacramento River. Elevation ranges from 800 to 7,000 feet. Topography is most rugged in the western part of the survey area where the soils are dominantly very steep. It is less rugged in the mountains in the eastern part where the soils are nearly level to very steep.

The Sacramento River enters the survey area as a deeply entrenched stream. Its valley becomes wider as the river flows southward.

Annual precipitation ranges from 30 to 70 inches. The greatest amount is received in the northeastern part of the survey area. Much of the precipitation falls as snow. The vegetation is mostly a conifer and hardwood forest, but shrubs cover some areas. Soils of this group occupy about 45 percent of the survey area.

Four associations in the Shasta County Area are in the mountains. Soils of these four associations are underlain by granitic, volcanic, sedimentary, and metamorphic rock.

1. Cohasset-Windy-McCarthy association

Nearly level to very steep, well-drained very gravelly or very cobbly sandy loams and loams to gravelly and very cobbly clay loams underlain by basic volcanic rocks; nonstony to very stony on the surface

This association commonly consists of gently sloping or rolling soils on broad lava flows and very steep soils on mountains of volcanic rock. It is in the eastern part of the survey area and extends from Big Bend to southeast of Shingletown. Slopes range from 0 to 75 percent. Elevation ranges from 2,000 to 7,000 feet. The annual precipitation is 35 to 70 inches, and the average annual air temperature is 44° to 54° F. The 32° F. growing season is 100 to 225 days. The vegetation on these soils generally includes such trees as ponderosa pine, Douglas fir, white fir, sugar pine, and black oak. In places large brush fields of manzanita and chinquapin are mixed with young conifers.

This association occupies about 28 percent of the survey area. Cohasset soils make up about 40 percent of the association, and Windy and McCarthy soils, which are undifferentiated, together make up about 25 percent of the association. The remaining 35 percent consists of areas of Aiken and Supan soils at lower elevations and Jiggs and Lyonsville soils at higher elevations.

Cohasset soils are nearly level to moderately steep in most places. These soils have a surface layer of dark reddish-brown and yellowish-red loam and a subsoil of yellowish-red loam and gravelly clay loam that grades to yellowish-red very cobbly clay loam. Weathered andesite typically is at a depth of 24 to more than 60 inches. These soils range from nonstony to very stony on the surface.

Windy soils have a surface layer of very dark grayish-brown sandy loam and loamy sand and a subsurface layer of brown sandy loam. The subsoil is light yellowish-brown very gravelly sandy loam. These soils formed in material that weathered from basic volcanic rock. Depth to bedrock ranges from 40 to 60 inches. These soils are stony or very stony on the surface.

McCarthy soils have a surface layer of dark-brown gravelly sandy loam and a subsoil of strong-brown and yellowish-red very cobbly sandy loam. Hard basalt is at a depth of 40 to 60 inches. These soils range from stony to very stony on the surface.

The soils of this association are among the greatest producers of timber in the survey area. Large acreages are owned by lumber companies, and many small areas are used for recreation. Grazing in summer by cattle is common. The association is suited to timber production. At elevations below 4,000 feet, small areas of Cohasset soils are used for irrigated pasture. A few areas of Cohasset soils are well suited to apple orchards.

2. Josephine-Marpa-Sheetiron association

Strongly sloping to very steep, well-drained and somewhat excessively drained gravelly and very gravelly loams and clay loams underlain by sedimentary and metamorphic rocks

This association consists of soils on some of the most rugged topography in the area. Ridgetops are narrow, and valleys are deeply entrenched. This association is near Ono, French Gulch, and Ingot and along the Pit River. The soils in this association formed in material that weathered from sandstone, shale, and slate. Slopes range from 10 to 90 percent, but slopes are more than 50 percent in about two-thirds of the area. Elevation ranges from 800 to 5,000 feet. The annual precipitation is 30 to 60 inches, and the average annual air temperature is 50° to 56° F. The 32° F. growing season is 100 to 250 days. The vegetation on these soils is a conifer-hardwood type and includes such trees as Douglas-fir, pine, oak, and shrubs.

This association occupies about 6 percent of the survey area. Josephine soils make up 30 percent of the association, Marpa soils 25 percent, and Sheetiron soils 15 percent. The remaining 30 percent consists of areas of Maymen, Sites, and other soils.

Josephine soils are intermingled with Marpa soils and are also on slopes at lower elevations. Josephine soils are well drained. They have a surface layer of brown gravelly loam and a subsoil of light-brown gravelly clay loam that grades to light reddish-brown very stony clay loam. Shale bedrock is at a depth of 24 to more than 60 inches. Areas of Landslides are included in a few places.

Marpa soils are on slopes below Sheetiron soils. They are well drained. They have a surface layer of brown gravelly loam and a subsoil of brown gravelly loam and light-brown very gravelly clay loam. Shale bedrock is at a depth of 20 to 40 inches.

Sheetiron soils are on the upper side slopes and ridgetops at the highest elevations. They are well drained and somewhat excessively drained. They have a surface layer of gray and light-gray very stony loam and very gravelly loam and a subsoil of light-gray gravelly and very gravelly loam. Slate bedrock is at a depth of 18 to 40 inches.

The soils of this association are used mainly for production of timber. Other uses are recreation, mining, grazing, wildlife habitat, and watershed. Little forage is available for domestic livestock, and range improvement practices generally are not applicable. Fire control is difficult because the soils are steep and slopes are irregular.

3. *Chaix-Corbett association*

Gently sloping to very steep, well-drained to excessively drained sandy loams and loamy coarse sands underlain by granitic rocks

This association consists of soils on rough terrain in narrow valleys and on ridgetops that have rounded to sharp tops. It is near the town of Shasta and extends to the western boundary of the survey area. The soils in this association are underlain by granitic rock. Slopes range from 5 to 80 percent, but they are mostly more than 30 percent. Elevation ranges from 1,000 to 6,500 feet. The annual precipitation is 30 to 60 inches, and the average annual air temperature is 45° to 55° F. The 32° F. growing season is 100 to 250 days. The vegetation on these soils is mainly trees, an understory of shrubs, and a sparse cover of grass or brush. The main tree species are ponderosa pine, Douglas-fir, white fir, and oaks.

This association occupies about 7 percent of the survey area. Chaix soils make up about 45 percent of the association and Corbett soils 25 percent. The remaining 30 percent consists of areas of Sierra, Holland, and Kanaka soils.

Chaix soils are in warmer areas than Corbett soils. Generally they are at elevations of less than 3,500 feet, and Corbett soils are at higher elevations. Chaix soils are well drained and somewhat execessively drained. They have a surface layer of grayish-brown sandy loam and coarse sandy loam and a subsoil of brown heavy sandy loam. Weathered granite is at a depth of 20 to 40 inches.

Corbett soils are somewhat excessively drained and excessively drained. They are grayish-brown and light-gray loamy coarse sand throughout. Weathered granite is at a depth of 18 to 40 inches. A very small area of Corbett soils is very rocky and is steep to very steep.

The soils of this association are used mainly for the production of timber, as wildlife habitat, and for watershed.

4. *Maymen-Stonyford association*

Steep and very steep, somewhat excessively drained and well-drained gravelly loams and gravelly clay loams underlain by sedimentary, metamorphic, and metamorphosed basic rocks; very stony on the surface

This association consists of steep or very steep soils on the sides of deeply entrenched, narrow valleys and on ridges that have rounded to narrow tops. It is near Platina and French Gulch. The soils in this association formed in material that weathered from sandstone, shale, conglomerate, schist, or greenstone. Slopes range from 30 to 80 percent. Elevation ranges from 1,000 to 4,500 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is 56° to 60° F. The 32° F. growing season is 150 to 200 days. The vegetation on these soils is brush, a sparse understory of grass, and shrubs that are dominantly chamise and ceanothus.

This association occupies about 4 percent of the survey area. Maymen soils make up about 50 percent of the association and Stonyford soils about 35 percent. The remaining 15 percent consists of small areas of Rock land and of Boomer, Neuns, and Goulding soils.

Maymen soils are somewhat excessively drained. They have a surface layer of very stony loam and a subsoil of light-brown gravelly loam. Shale is at a depth of 6 to 20 inches. Maymen soils have many stones on the surface.

Stonyford soils are well drained. They have a surface layer of brown very stony loam and yellowish-red gravelly loam and a subsoil of reddish-yellow gravelly clay loam. Fractured greenstone is at a depth of 16 to 25 inches. Stonyford soils have many stones on the surface.

The soils of this association are used mainly as wildlife habitat, but they are also used to provide a small amount of feed for livestock and for watershed. Where areas have been burned, brushy plants sprout readily and cover the surface within a few years.

Soils of Foothills

The soils of this group are on foothills and generally are rolling to steep. These soils occupy less rugged topography at lower elevations than the soils of the mountains. Elevation ranges from 600 to 5,000 feet.

Annual precipitation ranges from 25 to 70 inches, but snowfall is less than in the mountains. The vegetation is grass, grass-oak, brush, and conifers. Soils of this group occupy 34 percent of the survey area.

Four associations in the Shasta County Area are in the foothills. The soils of these four associations formed in material weathered from sedimentary, volcanic, and metamorphic rock.

5. *Millsholm-Sehorn-Gaviota association*

Nearly level to very steep, well-drained and somewhat excessively drained sandy loams to loams and silty clays to silty clay loams underlain by sedimentary and metamorphic rocks; nonstony to very stony on the surface

This association consists of very steep soils on short slopes of low rolling hills and of nearly level to sloping soils in broad valleys. It is mainly near Ono and Platina, but small areas are near Bella Vista and south of Whitmore. The grass-covered, treeless "Bald Hills" area south of Ono is in this association. The soils in this association formed in material weathered from sandstone, shale, conglomerate, and metamorphic rocks. Slopes range from 0 to 75 percent. Elevation ranges from 600 to 1,800 feet. The annual precipitation is 25 to 40 inches, and the average annual air temperature is 60° to 62° F. The 32° F. growing season is 200 to 250 days. The vegetation on the Millsholm and Gaviota soils is grasses, forbs, oaks, and Digger pine; and the vegetation on Sehorn soils is grasses.

The association occupies 9 percent of the survey area. Millsholm soils make up about 40 percent of the acreage, Sehorn soils about 30 percent, and Gaviota soils about 10 percent. The remaining 20 percent consists of areas of Millsap, Lodo, and Tehama soils.

Millsholm soils are well drained. They are grayish-brown, light brownish-gray, and brown gravelly loam throughout the profile. Sandstone and conglomerate are at a depth of 8 to 20 inches. Some areas of Millsholm soils are very rocky.

Sehorn soils are well drained. They have a surface layer of light olive-brown silty clay that is underlain by mottled grayish-brown, light olive-brown, and yellowish-brown silty clay loam. Weathered shale is at a depth of 16 to 48 inches. Some areas of Sehorn soils are very stony.

Gaviota soils are well drained and somewhat excessively drained. They have a surface layer of yellowish-brown sandy loam or fine sandy loam that is underlain by sand-

stone at a depth of 8 to 18 inches. Some areas of Gaviota soils are very rocky.

The soils of this association are used as range, pasture, and wildlife habitat and for watershed. A small acreage is in irrigated pasture and alfalfa or is used for dryland pasture.

6. Kilarc-Sites association

Nearly level to very steep, moderately well drained and well drained clays and clay loams underlain by sedimentary and metamorphic rocks; nonstony to very stony on the surface

This association consists of rolling soils on hills and in broad valleys at lower elevations. It is in the eastern part of the survey area near Millville, Whitmore, Montgomery Creek, and Big Bend. Kilarc soils are underlain by sandstone, shale, and conglomerate rock; Sites soils are underlain by sandstone, conglomerate, or schist. Slopes range from 2 to 70 percent, and they are dissected at higher elevations. Elevation ranges from 600 to 4,000 feet. The annual precipitation is 30 to 70 inches, and the average annual air temperature is about 54° F. The 32° F. growing season is 150 to 225 days. The vegetation on Kilarc soils is oaks, Digger pine, shrubs, and grasses. Woody vegetation covers more than 50 percent of these soils. The vegetation on Sites soils consists of mixed conifers, oaks, shrubs, and grasses.

This association occupies about 3 percent of the survey area. Kilarc soils make up about 50 percent of the association and Sites soils about 25 percent. The remaining 25 percent consists of areas of Cohasset and Sehorn soils and small areas of Landslides.

Kilarc soils are moderately well drained. They have a surface layer of grayish-brown loam to sandy clay loam that is very stony in places. The subsoil is light brownish-gray and pale-brown clay and clay loam underlain by light-gray sandy clay loam. Weakly consolidated sandstone is at a depth of 25 to 45 inches. Kilarc soils are subject to landslips.

Sites soils are well drained. They have a surface layer of reddish-brown loam and a subsoil of yellowish-red and strong-brown clay loam and clay. Weathered rock is at a depth of 48 to more than 60 inches. Some areas of Sites soils are stony or very rocky.

Kilarc soils are used as range, pasture, wildlife habitat, and watershed. Sites soils are used for production of timber, as wildlife habitat, and as watershed. They are used for grazing along with Kilarc soils where the soils are intermingled. Areas of Landslides occur in a few places and are a hazard to road maintenance.

7. Auburn-Goulding-Neuns association

Nearly level to very steep, well-drained gravelly loams and clay loams and very gravelly silty clay loams underlain by partly metamorphosed volcanic rocks; nonstony to very stony on the surface

This association generally consists of very steep soils on sides of narrow valleys at higher elevations and smooth and rolling soils in broad valleys at lower elevations. It is near Whiskeytown Reservoir, French Gulch, and Ingot. The soils in this association formed in material weathered from greenstone and other basic metavolcanic rock. Slopes are 0 to 80 percent. Elevation ranges from 700 to 5,000 feet. The annual precipitation is 30 to 60 inches, and the average annual air temperatue is 52° to 62° F. The 32° F. growing season is 150 to 250 days. The vegetation on Auburn and Goulding soils is shrubs, oaks, Digger pine, and grasses. Shrubs are the main vegetation in many places. The vegetation on Neuns soils is mixed conifers, oaks, and shrubs.

This association occupies about 10 percent of the survey area. Auburn soils and Goulding soils are about equal in extent and together make up about 60 percent of the association. Neuns soils make up about 15 percent. The remaining 25 percent consists of areas of Boomer, Diamond Springs, and other soils.

Auburn soils have a surface layer of yellowish-red loam or clay loam and a subsoil of yellowish-red gravelly clay loam. Basic metavolcanic rock is at a depth of 12 to 32 inches. Some areas of Auburn soils are very stony or very rocky.

Goulding soils have a surface layer of brown loam and a subsoil of pale-brown gravelly loam. Fractured greenstone is at a depth of 12 to 24 inches. All areas of Goulding soils are very stony or very rocky.

Neuns soils have a surface layer of pale-brown loam that is underlain by very pale brown very gravelly silty clay loam. Greenstone is at a depth of 20 to 40 inches. All areas of Neuns soils are very stony on the surface.

Auburn and Goulding soils are used as range, wildlife habitat, and watershed. Small areas of Auburn soils are used for cultivated crops. Many abandoned mines are on Auburn and Goulding soils. Neuns soils are used for production of timber, as wildlife habitat, and for watershed.

8. Toomes-Guenoc-Supan association

Nearly level to steep, well-drained and somewhat excessively drained stony loams and gravelly to very cobbly clay loams underlain by volcanic rocks; nonstony to very stony on the surface

This association consists of nearly level to sloping soils on broad ridges and moderately steep to steep soils on side slopes. It is near Oak Run, Whitmore, Millville, and Shingletown. The soils in this association are underlain by andesitic tuff breccia and lava flow rocks. Slopes range from 0 to 50 percent. Elevation ranges from 800 to 2,000 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is 52° to 60° F. The 32° F. growing season is 175 to 225 days. The vegetation on Toomes soils is grasses, forbs, and an open stand of oaks, shrubs, and Digger pine. In many places the Toomes soils are treeless and have a sparse cover of grasses and brush. The vegetation on Guenoc and Supan soils is grasses, forbs, and an open to dense stand of woody vegetation consisting of oaks, Digger pine, and shrubs.

This association occupies about 12 percent of the survey area. Toomes soils make up about 45 percent of the association, Guenoc soils about 40 percent, and Supan soils about 10 percent. The remaining 5 percent consists of areas of Inks and Kilarc soils.

Toomes soils are well drained and somewhat excessively drained. They are brown very stony and stony loams that are underlain, at a depth of 4 to 20 inches, by tuff breccia. About 15 to 25 percent of the area consists of rock outcrops.

Guenoc soils are well drained. They have a surface layer of reddish-brown very stony loam and a subsoil of dark-

red cobbly and very cobbly clay loam. Andesite bedrock is at a depth of 20 to 40 inches. Some areas are very rocky.

Supan soils are well drained. They have a surface layer of dark grayish-brown gravelly loam and loam and a subsoil of dark-brown gravelly clay loam. Tuff breccia is at a depth of 24 to 40 inches. Some areas are very stony.

The soils of this association are used as range, wildlife habitat, and watershed. Small areas have been cleared of stones. Some areas have been cleared of trees and brush by use of chemicals or by crushing, followed by burning, then by planting of improved range species. Most areas are in large cattle ranches, and few roads are present.

Soils of Terraces, Valley Bottoms, and Flood Plains

This physiographic region consists of soils on dissected terraces that are nearly level or undulating on the broad tops and sloping to steep soils on side slopes along with nearly level soils in valley bottoms and on flood plains. The soils formed in alluvium of various ages. Elevation ranges from 350 to 1,000 feet.

Annual precipitation is 25 to 40 inches, little of which is snowfall. The vegetation was grass-oak, brush, Digger pine, cottonwood, and sycamore. The soils in this physiographic position occupy about 21 percent of the survey area.

Four associations in the survey area are in this position. Small areas of Cobbly alluvial land, Riverwash, and other miscellaneous land types also are present.

9. Newtown-Red Bluff association

Nearly level to steep, well drained and moderately well drained clays and clay loams formed in old alluvium on high terraces

This association consists of sloping to steep soils on side slopes of dissected terraces and of nearly level or undulating soils on broad terrace tops. Red Bluff soils are nearly level to gently sloping and are on terrace tops. Newtown soils are moderately sloping to steep and are on the sides of terraces. In most places the terrace tops are 50 to 100 feet above the bottoms of the entrenched streams. Cow Creek and Stillwater Creek have broad valleys; other valleys are generally narrow. This association is in the central part of the survey area near Olinda, Redding, Bella Vista, Palo Cedro, and Anderson. The soils in this association formed in weathered gravelly alluvium from mixed sources. Slopes range from 0 to 50 percent. Elevation ranges from 500 to 1,000 feet. The annual precipitation is 25 to 40 inches, and the average annual air temperature is 62° to 63° F. The 32° F. growing season is 200 to 250 days. The vegetation on these soils is grasses, oaks, shrubs, and Digger pine.

This association occupies about 11 percent of the survey area. Newtown soils make up about 55 percent of the association and Red Bluff soils about 35 percent. The remaining 10 percent consists of areas of Redding, Los Robles, Perkins, and other soils.

Newtown soils are well drained. They have a surface layer of brown stony loam and mottled very pale brown and brown very gravelly clay loam and a subsoil of brown clay. They have a substratum of pale-brown silty clay loam and cobbly silty clay loam.

Red Bluff soils are well drained and moderately well drained. They have a surface layer of brown gravelly loam or loam and a subsoil of yellowish-red and red clay loam and clay. They have a substratum of light-brown clay loam that is gravelly and consolidated in places.

The soils in this association are used as range and pasture, for irrigated crops, as wildlife habitat, and for urban development. Water distribution systems are being extended in several areas for domestic water supply and for irrigation. These systems accelerate changes in land use and urbanization. Irrigated crops are mainly small areas of olives and strawberries on Red Bluff soils. Some areas have been cleared of trees and brush and reseeded to grasses and legumes.

10. Churn-Perkins-Tehama association

Nearly level to moderately steep, well drained and moderately well drained clay loams and silty clay loams formed in recent alluvium on low terraces

This association consists mostly of nearly level to undulating soils in narrow to broad valleys on terraces. Perkins and Tehama soils are on the higher areas of these intermediate terraces, and Churn soils are on the lower areas. This association is in the south-central part of the survey area in the valleys of Cottonwood Creek, Sacramento River, Clear Creek, and Churn Creek. The soils in this association formed in mixed alluvium. They are intermediate in elevation between the bottom lands and the adjacent highest terraces. Slopes range from 0 to 30 percent. Elevation ranges from 500 to 1,000 feet. The annual precipitation is 25 to 40 inches, and the average annual air temperature is 62° to 65° F. The 32° F. growing season is 200 to 275 days. The native vegetation, composed of oaks, Digger pine, shrubs, grasses, and forbs, has been removed from most areas of the soils.

This association occupies about 5 percent of the survey area. Churn soils make up about 40 percent of the association, Perkins soils about 30 percent, and Tehama soils about 20 percent. The remaining 10 percent consists of areas of Hillgate, Los Robles, and other soils.

Churn soils are well drained and moderately well drained. They have a surface layer of light yellowish-brown gravelly loam and loam and a subsoil of light yellowish-brown gravelly clay loam or clay loam.

Perkins soils are well drained and moderately well drained. They have a surface layer of brown gravelly loam or loam and a subsoil and substratum of yellowish-red gravelly clay loam.

Tehama soils are well drained. They have a surface layer of pale-brown loam and a subsoil of pale-brown silty clay loam and yellowish-brown silty clay loam and very gravelly clay loam.

The soils of this association are used as range, for irrigated pasture and alfalfa, as wildlife habitat, and for urban development. Small areas are used for orchards. The soils are suited to most locally grown crops. Urban development is rapidly expanding.

11. Tuscan-Igo association

Nearly level and gently sloping, well-drained cobbly clay loams and gravelly loams that contain a hardpan and that formed in old basic alluvium on high terraces

This association consists of nearly level to undulating, hummocky soils on tops of dissected high terraces. It is

near Bella Vista and Millville and extends to the southern boundary of the survey area. The treeless Swede Creek Plains and Millville Plains are in this association. The soils in this association formed in old basic alluvium. Slopes range from 0 to 8 percent. Elevation ranges from 600 to 1,000 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 225 to 275 days. The vegetation on Igo soils is a sparse cover of annual grasses and forbs, and the vegetation on Tuscan soils is grasses and forbs and scattered oaks and shrubs.

The association occupies about 2 percent of the survey area. Tuscan soils and Igo soils are about equal in extent and together make up about 70 percent of the association. The remaining 30 percent consists of areas of Inks, Supan, and Keefers soils.

Tuscan soils have a surface layer of brown cobbly loam and a subsoil of reddish-brown cobbly clay loam. An indurated hardpan is at a depth of 8 to 20 inches.

Igo soils have a surface layer and subsoil of yellowish-red gravelly loam. An indurated hardpan is at a depth of 3 to 12 inches.

The soils of this association are used as range and dry-land pasture. A small acreage of Tuscan soils is used as irrigated pasture.

12. Reiff-Cobbly alluvial land association

Nearly level to gently sloping, moderately well drained to excessively drained loamy fine sands to loams and frequently flooded cobbly land on valley bottoms and flood plains

The soils and land types in this association are on bottom lands and flood plains along the Sacramento River. Reiff soils are generally in large, nearly level to gently sloping tracts in the highest parts of the association, and Cobbly alluvial land is in smaller, narrow tracts along the stream course and in old channels. The soils in this association formed in very deep deposits of recent mixed alluvium. Slopes range from 0 to 8 percent. Elevation ranges from 350 to 500 feet. The annual precipitation is 25 to 40 inches, and the average annual air temperature is about 63° F. The 32° F. growing season is 250 to 275 days. Most areas of Reiff soils have been cleared of natural vegetation and are farmed. The vegetation on Cobbly alluvial land consists of an open to dense stand of cottonwood, sycamore, willow, and oak trees and of an understory of shrubs, vines, and annual grasses.

This association occupies about 3 percent of the survey area. Reiff soils make up about 60 percent of the association and Cobbly alluvial land and Cobbly alluvial land, frequently flooded, about 30 percent. The remaining 10 percent consists of areas of Anderson soils, Riverwash, and other land types.

Reiff soils are well drained and moderately well drained. They have a surface layer of grayish-brown and brown sandy loam, fine sandy loam, gravelly fine sandy loam, gravelly loam, or loam. The substratum is brown, similar-textured material.

Cobbly alluvial land, frequently flooded, is flooded each year in winter. It is a mixture of gravelly and cobbly alluvium that is excessively drained. Cobbly alluvial land is protected from flooding by Shasta Dam.

If Reiff soils are irrigated, they are suited to nearly all locally grown crops, such as alfalfa, pasture, and vegetables. Small areas of this soil are used for walnuts and other orchard crops. These soils are used extensively for urban development and this use is increasing. Cobbly alluvial lands are used principally for grazing, as a source of gravel, as wildlife habitat, and for recreation. The hazard of flooding is severe on much of the Cobbly alluvial lands; consequently, intensive use of the areas is restricted. The Sacramento River flows through the association and is used extensively for recreation, as well as a source of irrigation water.

Descriptions of the Soils

This part of the survey describes the soil series and mapping units in the survey area. Each soil series is described in considerable detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series is true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of a dry soil. In these descriptions the content of stones is expressed as a percentage of the total volume of soil material.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Cobbly alluvial land, for example, does not belong to a soil series. Nevertheless, it is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, woodland group, range site, and wildlife group in which the mapping unit has been placed. The page for the description of each capability unit, woodland group, range site, wildlife group, or other interpretative group can be found by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*14*).[2]

A given soil series in this survey area may be identified by a different name in a recently published soil survey of an adjacent area. Such differences in name result from changes in the concepts of soil classification that have occurred since publication. The characteristics of the soil

[2] Italic numerals in parentheses refer to Literature Cited, p. 158.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Aiken loam, 0 to 8 percent slopes	7, 180	0. 7
Aiken loam, 8 to 15 percent slopes	6, 285	. 6
Aiken loam, 15 to 30 percent slopes	3, 080	. 3
Aiken stony loam, 0 to 8 percent slopes	8, 180	. 8
Aiken stony loam, 8 to 15 percent slopes	7, 800	. 8
Aiken stony loam, 15 to 30 percent slopes	10, 850	1. 1
Aiken very stony loam, 30 to 50 percent slopes	1, 080	. 1
Anderson gravelly sandy loam	4, 350	. 4
Anderson gravelly sandy loam, moderately deep	775	(1)
Anita clay, 0 to 8 percent slopes	190	(1)
Anita very cobbly clay, 0 to 8 percent slopes	305	(1)
Auberry fine sandy loam, 0 to 8 percent slopes	165	(1)
Auberry fine sandy loam, 8 to 30 percent slopes	800	(1)
Auberry fine sandy loam, 30 to 70 percent slopes	240	(1)
Auburn loam, 0 to 8 percent slopes	2, 845	. 3
Auburn loam, 8 to 30 percent slopes	2, 535	. 3
Auburn very stony loam, 8 to 30 percent slopes	5, 150	. 5
Auburn clay loam, 8 to 30 percent slopes, eroded	7, 915	. 8
Auburn very stony clay loam, 30 to 50 percent slopes, eroded	8, 560	. 8
Auburn very rocky clay loam, 50 to 70 percent slopes, eroded	4, 165	. 4
Behemotosh very stony loam, 8 to 30 percent slopes	780	(1)
Behemotosh very stony loam, 30 to 50 percent slopes, eroded	530	(1)
Behemotosh very rocky loam, 50 to 70 percent slopes, eroded	1, 875	. 2
Boomer gravelly loam, 0 to 15 percent slopes	1, 060	. 1
Boomer gravelly loam, 15 to 30 percent slopes	3, 045	. 3
Boomer gravelly loam, 30 to 50 percent slopes	4, 275	. 5
Boomer very stony loam, 50 to 70 percent slopes	2, 110	. 2
Boomer very stony clay loam, 30 to 50 percent slopes, severely eroded	1, 090	. 1
Boomer very stony clay loam, 50 to 70 percent slopes, severely eroded	450	(1)
Chaix coarse sandy loam, 30 to 50 percent slopes, severely eroded	4, 875	. 5
Chaix coarse sandy loam, 50 to 70 percent slopes, severely eroded	7, 965	. 8
Chaix sandy loam, 5 to 30 percent slopes, eroded	1, 430	. 1
Chaix sandy loam, 30 to 50 percent slopes	5, 205	. 5
Chaix sandy loam, 50 to 70 percent slopes	13, 505	1. 4
Churn loam, 0 to 3 percent slopes	1, 845	. 2
Churn loam, 3 to 8 percent slopes	195	(1)
Churn loam, slightly wet, 0 to 3 percent slopes	1, 285	. 1
Churn gravelly loam, 0 to 3 percent slopes	8, 630	. 8
Churn gravelly loam, 3 to 8 percent slopes	1, 260	. 1
Churn gravelly loam, deep, 0 to 3 percent slopes	6, 155	. 6
Churn gravelly loam, deep, 3 to 8 percent slopes	970	(1)
Clough gravelly loam, 3 to 8 percent slopes	3, 065	. 3
Cobbly alluvial land	1, 785	. 2
Cobbly alluvial land, frequently flooded	4, 215	. 4
Cohasset loam, 0 to 30 percent slopes	19, 910	2. 0
Cohasset stony loam, 0 to 30 percent slopes	57, 645	5. 7
Cohasset stony loam, 30 to 50 percent slopes	27, 330	2. 7
Cohasset very stony loam, 50 to 70 percent slopes	3, 815	. 4
Cohasset very stony loam, moderately deep, 8 to 50 percent slopes	4, 175	. 4
Cohasset-Aiken stony loams, 0 to 30 percent slopes	2, 820	. 2
Cohasset-McCarthy complex, 0 to 30 percent slopes	1, 645	. 2
Cohasset-McCarthy complex, 30 to 50 percent slopes	2, 540	. 3
Cohasset-McCarthy complex, 50 to 75 percent slopes	1, 310	. 1
Colluvial land	15, 655	1. 6
Cone gravelly loam, 3 to 15 percent slopes	1, 435	. 1
Cone gravelly loam, 15 to 30 percent slopes	330	(1)
Cone stony loam, 3 to 30 percent slopes	875	(1)
Cone very stony loam, 30 to 50 percent slopes	600	(1)
Cone very stony loam, moderately deep, 15 60 percent slopes	675	(1)
Corbett loamy coarse sand, 15 to 50 percent slopes	1, 585	. 2
Corbett loamy coarse sand, 30 to 70 percent percent slopes, severely eroded	6, 180	. 5
Corbett loamy coarse sand, 50 to 80 percent slopes	10, 270	1. 0
Corbett very rocky loamy coarse sand, 30 to 80 percent slopes	745	(1)
Diamond Springs very stony sandy loam, 8 to 30 percent slopes, eroded	2, 650	. 3
Diamond Springs very rocky sandy loam, 30 to 50 percent slopes, eroded	2, 420	. 2
Diamond Springs very rocky sandy loam, 30 to 50 percent slopes, severely eroded	2, 550	. 2
Forward sandy loam, 5 to 30 percent slopes	1, 410	. 1
Forward sandy loam, 30 to 50 percent slopes	2, 695	. 3
Forward sandy loam, deep, 0 to 30 percent slopes	1, 095	. 1
Gaviota fine sandy loam, 3 to 15 percent slopes	705	(1)
Gaviota fine sandy loam, 15 to 30 percent slopes	595	(1)
Gaviota very rocky sandy loam, 0 to 30 percent slopes	4, 475	. 4
Gaviota very rocky sandy loam, 30 to 50 percent slopes, eroded	610	(1)
Goulding very stony loam, 10 to 30 percent slopes	7, 765	. 8
Goulding very rocky loam, 30 to 50 percent slopes, eroded	9, 995	1. 0
Goulding very rocky loam, 50 to 70 percent slopes, eroded	12, 145	1. 2
Gravel pits	545	(1)
Guenoc very stony loam, 0 to 30 percent slopes	9, 870	1. 0
Guenoc very rocky loam, 0 to 30 percent slopes	30, 975	3. 1
Guenoc very rocky loam, 30 to 50 percent slopes	3, 560	. 3
Henneke very rocky loam, 15 to 60 percent slopes	1, 325	. 1
Hillgate loam	2, 095	. 2
Holland sandy loam, 15 to 50 percent slopes	1, 650	. 2
Holland sandy loam, 50 to 70 percent slopes	465	(1)
Honcut loam	780	(1)
Honcut gravelly loam	845	(1)
Honcut gravelly loam, deep	295	(1)
Honn fine sandy loam, 0 to 3 percent slopes	415	(1)
Honn fine sandy loam, 3 to 8 percent slopes	230	(1)
Honn gravelly sandy loam, 0 to 3 percent slopes	630	(1)
Igo gravelly loam, 0 to 8 percent slopes	6, 710	. 7
Inks gravelly loam, 8 to 30 percent slopes	4, 560	. 5
Inks very stony loam, 3 to 30 percent slopes	1, 365	. 1
Inks very stony loam, 30 to 50 percent slopes	785	(1)
Inks-Pentz complex, 5 to 30 percent slopes	1, 045	. 1
Inks-Pentz complex, 30 to 50 percent slopes	3, 270	. 3

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*—Continued

Soil	Acres	Percent	Soil	Acres	Percent
Josephine gravelly loam, 10 to 30 percent slopes	2,230	.2	Millsholm very rocky loam, 30 to 50 percent slopes, eroded	5,565	.6
Josephine gravelly loam, 30 to 50 percent slopes	3,470	.3	Millsholm very rocky loam, 50 to 70 percent slopes, eroded	2,030	.2
Josephine gravelly loam, 50 to 70 percent slopes	7,885	.8	Moda loam, 0 to 3 percent slopes	1,125	.1
Josephine gravelly loam, moderately deep, 10 to 30 percent slopes	620	(1)	Moda loam, seeped, 0 to 3 percent slopes	980	(1)
Josephine gravelly loam, moderately deep, 30 to 50 percent slopes	3,345	.3	Moda loam, shallow, 0 to 5 percent slopes	1,700	.1
Josephine-Sheetiron complex, 50 to 70 percent slopes	1,705	.2	Molinos sandy loam, channeled	375	(1)
Kanaka sandy loam, 3 to 15 percent slopes	455	(1)	Molinos fine sandy loam	415	(1)
Kanaka rocky sandy loam, 5 to 30 percent slopes	1,795	.2	Molinos fine sandy loam, seeped	715	(1)
Kanaka rocky sandy loam, 30 to 50 percent slopes	2,920	.3	Myers silty clay, 0 to 3 percent slopes	780	(1)
Kanaka rocky sandy loam, 50 to 70 percent slopes, eroded	2,380	.2	Myers silty clay, 3 to 8 percent slopes	1,430	.1
Keefers gravelly loam, 0 to 3 percent slopes	2,405	.2	Nanny gravelly sandy loam, 0 to 8 percent slopes	5,055	.5
Keefers gravelly loam, 3 to 8 percent slopes	1,705	.2	Nanny stony sandy loam, 0 to 8 percent slopes	7,635	.7
Keefers cobbly loam, channelec, 1 to 5 percent slopes	1,365	.1	Nanny-Windy complex, 0 to 8 percent slopes	535	(1)
Kidd very rocky loam, 10 to 60 percent slopes eroded	1,300	.1	Neuns very stony loam, 8 to 50 percent slopes	3,785	.4
Kilarc sandy clay loam, 2 to 15 percent slopes	600	(1)	Neuns very stony loam, 50 to 80 percent slopes	8,165	.8
Kilarc sandy clay loam, 15 to 30 percent slopes	3,855	.4	Newtown gravelly loam, 8 to 15 percent slopes	6,705	.7
Kilarc sandy clay loam, 30 to 50 percent slopes	915	(1)	Newtown gravelly loam, 15 to 30 percent slopes	5,470	1.5
Kilarc very stony sandy clay loam, 10 to 30 percent slopes	9,525	.9	Newtown gravelly loam, 30 to 50 percent slopes, eroded	32,335	3.2
Kilarc very stony sandy clay loam, 30 to 50 percent slopes	4,830	.5	Newtown stony loam, 8 to 50 percent slopes, eroded	7,540	.7
Kilarc-Sites complex, 8 to 30 percent slopes	300	(1)	Parrish loam, 8 to 30 percent slopes	1,635	.1
Landslides	740	(1)	Parrish loam, 30 to 50 percent slopes	5,140	.5
Lodo shaly loam, 10 to 50 percent slopes	7,675	.7	Parrish loam, 50 to 70 percent slopes	1,450	.1
Lodo shaly loam, 50 to 70 percent slopes, severely eroded	2,085	.2	Pentz-Supan complex, 50 to 70 percent slopes	3,275	.3
Los Robles loam, 0 to 3 percent slopes	3,600	.4	Perkins loam, 0 to 3 percent slopes	2,390	.2
Los Robles loam, 3 to 8 percent slopes	220	(1)	Perkins gravelly loam, 0 to 3 percent slopes	5,115	.5
Los Robles loam, seeped, 0 to 3 percent slopes	375	(1)	Perkins gravelly loam, 3 to 8 percent slopes	2,345	.2
Los Robles loam, moderately deep, 0 to 5 percent slopes	250	(1)	Perkins gravelly loam, 8 to 15 percent slopes	950	(1)
Los Robles gravelly loam, 0 to 3 percent slopes	240	(1)	Perkins gravelly loam, 15 to 30 percent slopes	1,530	.1
Lyonsville-Jiggs complex, 10 to 50 percent slopes	2,315	.3	Perkins gravelly loam, seeped, 0 to 3 percent slopes	350	(1)
Lyonsville-Jiggs complex, deep, 10 to 50 percent slopes	7,590	.8	Perkins gravelly loam, moderately deep, 0 to 3 percent slopes	1,740	.2
Lyonsville and Jiggs soils, 50 to 70 percent slopes	1,665	.2	Perkins gravelly loam, moderately deep, 3 to 8 percent slopes	1,670	.2
Marpa gravelly loam, 30 to 50 percent slopes	4,980	.5	Red Bluff loam, 0 to 3 percent slopes	16,330	1.6
Marpa gravelly loam, 50 to 75 percent slopes	9,020	.9	Red Bluff loam, 3 to 8 percent slopes	3,540	.3
Mayman very stony loam, 30 to 80 percent slopes, eroded	19,045	1.8	Red Bluff gravelly loam, moderately deep, 0 to 3 percent slopes	11,875	1.2
Millsap loam, 5 to 30 percent slopes	1,145	.1	Red Bluff gravelly loam, moderately deep, 3 to 8 percent slopes	5,965	.6
Millsap loam, 30 to 50 percent slopes	4,455	.4	Redding gravelly loam, 0 to 3 percent slopes	4,120	.4
Millsap loam, 50 to 75 percent slopes	645	(1)	Redding gravelly loam, 3 to 8 percent slopes	4,365	.4
Millsap very rocky loam, 10 to 50 percent slopes	275	(1)	Redding-Red Bluff gravelly loams, 0 to 3 percent slopes	2,680	.3
Millsholm gravelly loam, 3 to 30 percent slopes	11,635	1.2	Redding-Red Bluff gravelly loams, 3 to 8 percent slopes	790	(1)
Millsholm gravelly loam, 3 to 30 percent slopes, eroded	1,230	.1	Reiff sandy loam, channeled, 0 to 8 percent slopes	195	(1)
Millsholm gravelly loam, 30 to 50 percent slopes	11,750	1.2	Reiff fine sandy loam, 0 to 3 percent slopes	3,430	.3
Millsholm gravelly loam, 50 to 75 percent slopes	2,435	.2	Reiff fine sandy loam, 3 to 8 percent slopes	550	(1)
			Reiff fine sandy loam, deep, 0 to 3 percent slopes	345	(1)
			Reiff gravelly fine sandy loam, deep, 0 to 3 percent slopes	500	(1)
			Reiff loam, 0 to 3 percent slopes	4,850	.5
			Reiff loam, seeped, 0 to 3 percent slopes	1,245	.1
			Reiff gravelly loam, 0 to 3 percent slopes	330	(1)
			Reiff gravelly loam, slightly wet, 0 to 3 percent slopes	260	(1)
			Riverwash	5,370	.5
			Rock land	15,570	1.6
			Rubble land	2,520	.3

See footnote at end of table.

TABLE 1.—*Approximate acreage and proportionate extent of the soils* Continued

Soil	Acres	Percent
Sehorn silty clay, 3 to 8 percent slopes	290	(1)
Sehorn silty clay, 8 to 30 percent slopes	4, 505	. 4
Sehorn silty clay, 30 to 50 percent slopes	8, 110	. 8
Sehorn very stony silty clay, 8 to 30 percent slopes, eroded	2, 420	. 2
Sehorn silty clay, moderately deep, 8 to 30 percent slopes	1, 910	. 2
Sehorn silty clay, moderately deep, 30 to 50 percent slopes	6, 235	. 6
Sehorn complex, 50 to 70 percent slopes, eroded	1, 225	. 1
Sheetiron very stony loam, 30 to 50 percent slopes	515	(1)
Sheetiron very stony loam, 50 to 75 percent slopes	6, 360	. 6
Sheetiron very stony loam, 75 to 90 percent slopes	1, 745	. 2
Shingletown clay loam, 0 to 8 percent slopes	1, 120	. 1
Shingletown loam, drained, 0 to 3 percent slopes	585	(1)
Sierra sandy loam, 3 to 8 percent slopes	700	(1)
Sierra sandy loam, 8 to 15 percent slopes	2, 685	. 3
Sierra sandy loam, 15 to 30 percent slopes	870	(1)
Sierra sandy loam, 15 to 30 percent slopes, severely eroded	325	(1)
Sierra sandy loam, 30 to 50 percent slopes	795	(1)
Sites loam, 5 to 15 percent slopes	390	(1)
Sites loam, 15 to 30 percent slopes	945	(1)
Sites loam, 30 to 50 percent slopes	1, 335	. 1
Sites loam, 50 to 70 percent slopes	1, 070	. 1
Sites stony loam, 8 to 30 percent slopes	3, 835	. 3
Sites very rocky loam, 30 to 50 percent slopes	1, 395	. 1
Spreckels sandy loam, 0 to 3 percent slopes	590	(1)
Spreckels sandy loam, 3 to 8 percent slopes	2, 010	. 2
Stonyford very stony loam, 30 to 50 percent slopes	4, 955	. 5
Stonyford very stony loam, 50 to 75 percent slopes	8, 860	. 9
Supan gravelly loam, 5 to 15 percent slopes	810	(1)
Supan gravelly loam, 15 to 30 percent slopes	2, 225	. 2
Supan gravelly loam, 30 to 50 percent slopes	1, 945	. 2
Supan very stony loam, 0 to3 0 percent slopes	7, 735	. 8
Supan very stony loam, 30 to 50 percent slopes	3, 660	. 4
Tailings and Placer diggings	9, 140	. 9
Tehama loam, 0 to 3 percent slopes	3, 950	. 4
Tehama loam, 3 to 8 percent slopes	4, 690	. 5
Tehama loam, 8 to 15 percent slopes	1, 085	. 1
Toomes very rocky loam, 0 to 50 percent slopes	24, 890	2. 3
Toomes very stony loam, 0 to 30 percent slopes	29, 200	2. 7
Tujunga loamy sand, 0 to 3 percent slopes	420	(1)
Tujunga loamy sand, 3 to 8 percent slopes	175	(1)
Tuscan cobbly loam, 0 to 3 percent slopes	4, 620	. 5
Tuscan cobbly loam, 3 to 8 percent slopes	2, 350	. 2
Vina loam, 0 to 3 percent slopes	1, 510	. 1
Vina loam, seeped, 0 to 3 percent slopes	305	(1)
Vina gravelly loam, 3 to 8 percent slopes	335	(1)
Wet alluvial land	325	(1)
Windy and McCarthy stony sandy loams, 0 to 30 percent slopes	38, 595	3. 8
Windy and McCarthy very stony sandy loams, 30 to 50 percent slopes	18, 315	1. 8
Windy and McCarthy very stony sandy loams, 50 to 75 percent slopes	8, 285	. 8
Windy and McCarthy very rocky sandy loams, 8 to 50 percent slopes	2, 855	. 3
Total	1, 035, 000	100. 0

1 Less than 0.1 percent.

series described in the survey area are considered to be within the range defined for that series. In those instances where a soil series has one or more features outside the defined range, the differences are explained.

Aiken Series

The Aiken series consists of well-drained soils formed on lava flows in material weathered from volcanic rock. They are in the eastern part of the survey area from Shingletown to Big Bend. Slopes range from 0 to 50 percent. Elevation ranges from 1,200 to 4,000 feet. Annual precipitation is 35 to 60 inches, and the average annual air temperature is about 52° F. The 32° F. growing season is 150 to 225 days, and the 28° F. growing season is 250 to 300 days. The vegetation is mainly that of a coniferous forest.

In a representative profile the surface layer is brown and reddish-brown, slightly acid and medium acid loam and clay loam about 10 inches thick. The surface layer is underlain by a reddish-brown, medium acid, clay loam transitional layer about 14 inches thick. The subsoil is yellowish-red and reddish-brown, medium acid clay that extends to a depth of more than 80 inches.

Most areas of these soils are used as woodland and wildlife habitat. A few small areas are used for apple orchards and as irrigated pasture.

Representative profile of Aiken loam, 0 to 8 percent slopes, about 1 mile east-southeast of Inwood, in NE¼ NE¼ sec. 26, T. 31 N., R. 1 W.:

O1—½ inch to 0, very strongly acid decomposing organic matter.

A1—0 to 1 inch, brown (7.5YR 5/3) loam, dark brown (7.5YR 3/2) moist; strong, fine, granular structure; soft, friable, nonsticky and slightly plastic; common roots; many very fine and fine interstitial pores; common concretions; slightly acid; abrupt, smooth boundary.

A3—1 to 10 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; weak, medium, subangular blocky structure and moderate, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common roots; many very fine and fine interstitial pores; common concretions; medium acid; clear, smooth boundary.

AB—10 to 24 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/4) moist; weak, coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common roots; common very fine and few fine tubular pores; few thin clay films in pores; common concretions; medium acid; gradual, smooth boundary.

B21t—24 to 48 inches, yellowish-red (5YR 4/6) clay, dark reddish brown (5YR 3/4) moist; moderate, medium, angular blocky structure; very hard, very firm, very sticky and very plastic; few roots; common fine interstitial pores and few fine tubular pores; common moderately thick and continuous thick clay films in pores; medium acid; gradual, smooth boundary.

B22t—48 to 66 inches, reddish-brown (5YR 5/3) clay, dark reddish brown (5YR 3/4) moist; weak, coarse, subangular blocky structure and moderate, medium, angular blocky structure; very hard, very firm, plastic and sticky; few roots; few fine interstitial pores and very few fine tubular pores; continuous thick clay films in pores and on ped faces; medium acid; gradual, smooth boundary.

B23t—66 to 90 inches, yellowish-red (5YR 5/6) clay, yellowish red (5YR 4/8) moist; moderate, medium, angular blocky structure; very hard, very firm, plastic and sticky; very few roots; few fine interstitial pores and very few fine tubular pores; continuous moderately thick clay films on ped faces; medium acid.

The A horizon ranges from 10 to 26 inches in thickness, from dark reddish brown to brown in color, from loam to clay loam in texture, and from slightly acid to medium acid in reaction. In places it is gravelly or stony or very stony. The Bt horizon is dark reddish brown or yellowish red to red in color and is medium acid to strongly acid in reaction. Weathered volcanic bedrock is at a depth of more than 60 inches. Stones cover 0 to 10 percent of the surface, and the content of stones is 0 to 35 percent throughout the profile.

Aiken soils generally are near areas of Cohasset, Guenoc, Kilarc, McCarthy, Sites, Supan, and Toomes soils.

Aiken loam, 0 to 8 percent slopes (AaB).—This soil has the profile described as representative for the series. Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 9 to 11 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Cohasset, Guenoc, and McCarthy soils.

This Aiken soil is used as woodland. Small areas have been cleared and planted to irrigated pasture or to apple orchards. Attempts to convert this soil to dryland pasture or range have not been satisfactory. Capability unit IIe–1(22); range site, not assigned; woodland suitability group 1; wildlife group 8.

Aiken loam, 8 to 15 percent slopes (AaC).—This soil has moderately slow permeability. Runoff is medium, and the hazard of erosion is moderate. Available water capacity is 9 to 11 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Cohasset, Guenoc, and McCarthy soils.

Most areas of this Aiken soil are in trees. A few small areas have been cleared and are used as irrigated pasture or for apple orchards. Capability unit IIIe–1(22); range site, not assigned; woodland suitability group 1; wildlife group 8.

Aiken loam, 15 to 30 percent slopes (AaD).—This soil has moderately slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 9 to 11 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Cohasset, Guenoc, and McCarthy soils.

Most areas of this Aiken soil are in trees. Capability unit IVe–1(22); range site, not assigned; woodland suitability group 2; wildlife group 8.

Aiken stony loam, 0 to 8 percent slopes (AbB).—This soil has moderately slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 7 to 9 inches. Roots can penetrate to a depth of more than 60 inches. Stones cover 1 to 3 percent of the surface, and the content of stones is 10 to 20 percent throughout the profile.

Included with this soil in mapping were small areas of Cohasset, Guenoc, and McCarthy soils.

Most areas of this Aiken soil are in trees. Small areas are used as irrigated pasture or for orchards. Capability unit IVe–1(22); range site, not assigned; woodland suitability group 4; wildlife group 8.

Aiken stony loam, 8 to 15 percent slopes (AbC).—This soil has moderately slow permeability. Runoff is medium, and the hazard of erosion is moderate. Available water capacity is 7 to 9 inches. Roots can penetrate to a depth of more than 60 inches. Stones cover 1 to 3 percent of the surface, and the content of stones is 10 to 20 percent throughout the profile.

Included with this soil in mapping were small areas of Cohasset, Guenoc, and McCarthy soils.

Most areas of this Aiken soil are in trees. Small areas are used as irrigated pasture and for orchards. Capability unit IVe–7(22); range site, not assigned; woodland suitability group 4; wildlife group 8.

Aiken stony loam, 15 to 30 percent slopes (AbD).—This soil has moderately slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 7 to 9 inches. Roots can penetrate to a depth of more than 60 inches. Stones cover 1 to 3 percent of the surface, and the content of stones is 0 to 20 percent throughout the profile.

Included with this soil in mapping were small areas of Cohasset, Guenoc, McCarthy, and Supan soils.

Most areas of this Aiken soil are in trees. Small areas are used as irrigated pasture and for orchards. Capability unit IVe–7(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Aiken very stony loam, 30 to 50 percent slopes (AcE).—This soil has moderately slow permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 7 to 9 inches. Roots can penetrate to a depth of 60 inches. Stones cover 3 to 10 percent of the surface, and the content of stones is 10 to 20 percent throughout the profile.

Included with this soil in mapping were small areas of Cohasset, Guenoc, McCarthy, and Supan soils.

This Aiken soil is used as woodland. Attempts to convert it to range have not been satisfactory. Capability unit VIs–1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Anderson Series

The Anderson series consists of somewhat excessively drained soils that formed in recent alluvium from mixed sources. These soils are in the central part of an area that extends from Cottonwood to Central Valley and Bella Vista on the Sacramento River alluvial plain. They are also in narrow valleys of tributary streams. Slopes range from 0 to 3 percent. In places these soils are subject to flooding for short periods in winter. Elevation ranges from 350 to 750 feet. The annual precipitation is 25 to 45 inches, and the average annual air temperature is about 65° F. The 32° F. growing season is 225 to 250 days, and the 28° F. growing season is 325 to 350 days. The vegetation is mainly annual grasses, but it includes scattered blue oak, interior live oak, ceanothus, and Digger pine.

In a representative profile the surface layer is brown, medium acid gravelly sandy loam about 14 inches thick.

The surface layer is underlain by a layer of strong-brown, medium acid gravelly sandy loam about 10 inches thick. The next layer is strong brown, medium acid very gravelly sand that extends to a depth of more than 60 inches.

If water is available, Anderson soils are used as irrigated pasture and for field crops. Otherwise, they are used as dryland pasture.

Representative profile of Anderson gravelly sandy loam, 2 miles northwest of Anderson and 700 feet west of the south end of the A.C.I.D. aqueduct over Spring Gulch:

A11—0 to 4 inches, brown (10YR 5/3) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; massive; soft, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; medium acid; clear, smooth boundary.

A12—4 to 14 inches, brown (10YR 5/3) gravelly sandy loam, dark yellowish brown (10YR 3/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine tubular pores; medium acid; gradual, smooth boundary.

C1—14 to 24 inches, strong-brown (7.5YR 5/6) gravelly sandy loam, dark brown (7.5YR 3/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and medium roots; many very fine interstitial pores; medium acid; gradual, smooth boundary.

C2—24 to 60 inches, strong-brown (7.5YR 5/6) very gravelly sand, reddish brown (5YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; many fine interstitial pores; medium acid.

The A horizon ranges from 5 to 15 inches in thickness, from brown to light brown in color, from gravelly sandy loam to gravelly loam in texture, and from slightly acid to medium acid in reaction. The C1 horizon ranges from 10 to 20 inches in thickness, from brown to light brown, strong brown, or reddish brown in color, and from slightly acid to medium acid in reaction. These soils are underlain, at a depth of 15 to 35 inches, by very gravelly or cobbly recent alluvium or consolidated alluvium. In some places these soils are underlain by older consolidated alluvium at a depth of 20 to 36 inches.

Anderson soils generally are near areas of Cobbly alluvial land, frequently flooded, and Newtown, Churn, Honcut, Perkins, Reiff, and Tujunga soils.

Anderson gravelly sandy loam (Ad).—This soil has the profile described as representative for the series. Permeability is rapid. Runoff is slow, and the hazard of erosion is none to slight. Available water capacity is 3.75 to 4.5 inches. Roots can penetrate to a depth of 60 inches.

Included with this soil in mapping were small areas of a soil that has slopes of 3 to 8 percent, areas of a similar soil that has a very gravelly surface layer, areas of Cobbly alluvial land, frequently flooded, and areas of Honcut and Tujunga soils.

This Anderson soil is used as dryland pasture and in a few areas for irrigated crops. Capability unit IIIs-0(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Anderson gravelly sandy loam, moderately deep (Ae).—This soil has a profile similar to the one described as representative for the series except that consolidated older alluvium is at a depth of 20 to 36 inches. Permeability is slow in this soil. Runoff is slow, and the hazard of erosion is none to slight. Available water capacity is 4 to 6 inches. The consolidated alluvium provides some water for plants.

Included with this soil in mapping were small areas of Honcut and Perkins soils and areas of Cobbly alluvial land, frequently flooded.

This Anderson soil is used as dryland pasture. Capability unit IIIs-3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Anita Series

The Anita series consists of somewhat poorly drained soils that are underlain by cemented andesite tuff. These soils are in small mountain valleys and depressions in the eastern part of the survey area near Black Butte and Oak Run. Slopes range from 0 to 8 percent. Elevation ranges from 800 to 1,500 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 60° F. The 32° F. growing season is 200 to 225 days, and the 28° F. growing season is 250 to 300 days. The vegetation is sedge, wiregrass, annual grasses, forbs, and perennial grasses.

In a representative profile the surface layer is dark-gray, mildly alkaline very cobbly clay and gravelly clay about 12 inches thick. The next layers are grayish-brown, neutral gravelly clay and mottled brown and reddish-brown, neutral gravelly sandy clay. Cemented andesitic tuff is at a depth of about 22 inches.

The areas of Anita soils are used as pasture.

Representative profile of Anita very cobbly clay, 0 to 8 percent slopes, about 4½ miles northwest of Black Butte and 1,000 feet east of the S¼ corner of sec. 34, T. 31 N., R. 2 W.:

A11—0 to 2 inches, dark-gray (10YR 4/1) very cobbly clay, very dark gray (10YR 3/1) moist; few, medium, distinct, dark-brown mottles; moderate, fine and medium, angular blocky structure; extremely hard, very firm, slightly sticky and very plastic; many very fine roots; many fine interstitial pores; mildly alkaline; abrupt, smooth boundary.

A12—2 to 12 inches, dark-gray (10YR 4/1) gravelly clay, very dark gray (10YR 3/1) moist; strong, coarse, angular blocky structure; extremely hard, very firm, sticky and very plastic; common very fine and fine roots; few fine tubular pores; few slickensides; mildly alkaline; clear, smooth boundary.

C1—12 to 20 inches, grayish-brown (2.5YR 5/2) gravelly clay, dark grayish brown (10YR 4/2) moist; few, fine, prominent, reddish-brown mottles; weak, medium, angular blocky structure; extremely hard, very firm, sticky and very plastic; few very fine and fine roots; few very fine tubular pores; common fine concretions; neutral; clear, smooth boundary.

C2—20 to 22 inches, mottled, brown and reddish-brown (10YR 5/3 and 5YR 4/4) gravelly sandy clay, reddish brown (5YR 4/4) moist; massive; extremely hard, very firm, sticky and very plastic; few very fine and fine roots; few very fine tubular pores; many thick clay films in pores; common fine concretions; neutral; abrupt, wavy boundary.

IIC3m—22 inches, cemented cobbly andesitic tuff.

The A horizon ranges from 6 to 12 inches in thickness, from very dark grayish brown to dark gray in color, from silty clay or clay to gravelly clay in texture, and from slightly acid to mildly alkaline in reaction. The C horizon ranges from 6 to 30 inches in thickness, from dark grayish brown to grayish brown, or mottled brown and reddish brown in color, and from neutral to moderately alkaline in reaction. Cemented tuff is at a depth of 12 to 42 inches. Cobblestones cover as much as 10 percent of the surface in places.

Anita soils generally are near areas of Guenoc, Toomes, and Tuscan soils.

Anita clay, 0 to 8 percent slopes (AhB).—This soil has slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 4 to 7 inches. A seasonal high water table is at

a depth of 1 to 3½ feet. Cemented tuff is at a depth of 24 to 42 inches. Very few, if any, cobblestones are on the surface.

Included with this soil in mapping were some areas of a similar soil that is very deep over cemented tuff. Also included is a soil that is similar to this soil, but it is steeper.

This Anita soil is used as dryland pasture. Capability unit IIIw-5(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 1.

Anita very cobbly clay, 0 to 8 percent slopes (AkB).—This soil has the profile described as representative for the series. Permeability is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 2 to 4 inches. A seasonal high water table is at a depth of 1 to 3½ feet. Cemented tuff is at a depth of 12 to 24 inches. Cobblestones cover about 3 to 10 percent of the surface.

Included with this soil in mapping were small areas of Guenoc and Toomes soils, small areas of peat around springs, and areas of a similar soil that is very deep over cemented tuff.

This Anita soil is used as pasture. Capability unit IVw-5(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 1.

Auberry Series

The Auberry series consists of well-drained soils that are underlain by weathered granitic rock. These soils are on uplands southwest of Redding near Centerville. Slopes are 0 to 70 percent. Elevation ranges from 700 to 1,500 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 64° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 275 to 325 days. The vegetation is grasses, blue oak, interior live oak, manzanita, and Digger pine.

In a representative profile the surface layer is light brownish-gray and pale-brown, neutral to medium acid fine sandy loam and loam about 22 inches thick. The subsoil is very pale brown, very strongly acid clay loam. Weathered granite is at a depth of about 27 inches.

The areas of Auberry soils are used as dryland pasture, range, and wildlife habitat and for watershed.

Representative profile of Auberry fine sandy loam, 8 to 30 percent slopes, on a county road right-of-way about 700 feet east of Centerville and 600 feet north of S¼ sec. 19, T. 31 N., R. 5 W.:

A11—0 to 3 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate, fine, granular and moderate, fine, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many very fine roots; many very fine interstitial and tubular pores; neutral; clear, smooth boundary.

A12—3 to 9 inches, pale-brown (10YR 6/3) light loam, brown (10YR 4/3) moist; massive; hard, friable, nonsticky and slightly plastic; many very fine and few fine roots; many very fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

A3—9 to 22 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky and slightly plastic; many very fine and few fine roots; many very fine tubular and interstitial pores; very few thin clay films in pores; medium acid; clear, smooth boundary.

B2t—22 to 27 inches, very pale brown (10YR 7/3) light clay loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and plastic; many very fine and few fine and medium roots; many very fine tubular and interstitial pores; few thin clay films in pores that are 1 chroma higher in color than rest of horizon; very strongly acid; gradual, smooth boundary.

C—27 inches, very pale brown (10YR 7/3) weathered granitic rock, yellowish brown (10YR 5/4) moist; strongly acid.

The A horizon ranges from 15 to 25 inches in thickness, from dark grayish brown to pale brown or light brownish gray in color, and from medium acid to neutral in reaction. The B horizon ranges from 5 to 24 inches in thickness, from pale brown to very pale brown in color, from light clay loam to sandy clay loam or clay loam in texture, and from strongly acid to very strongly acid in reaction. The C horizon, at a depth of 20 to 48 inches, is weathered granitic rock.

Auberry soils generally are near areas of Auburn, Behemotosh, Diamond Springs, Goulding, Kanaka, and Sierra soils.

Auberry fine sandy loam, 0 to 8 percent slopes (AlB).—This soil has moderately slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 4 to 9 inches. Weathered granite is at a depth of 24 to 48 inches.

Included with this soil in mapping were areas of Auburn and Kanaka soils.

This Auberry soil is used mainly as dryland pasture. Small areas are used for crops. Capability unit IIIe-1(17, 18); Granitic range site; woodland suitability group, not assigned; wildlife group 5.

Auberry fine sandy loam, 8 to 30 percent slopes (AlD).—This soil has the profile described as representative for the series. Permeability is moderately slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 3.5 to 6 inches. Weathered granite is at a depth of 20 to 37 inches.

Included with this soil in mapping were small areas of a similar pale-brown soil that is less than 20 inches deep over weathered granite. Also included were areas of Goulding and Sierra soils.

This Auberry soil is used as range. Capability unit VIe-1(15, 17, 18); Granitic range site; woodland suitability group, not assigned; wildlife group 5.

Auberry fine sandy loam, 30 to 70 percent slopes (AlF)—This soil has moderately slow permeability. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Available water capacity is 3.5 to 6 inches. Weathered granite is at a depth of 20 to 37 inches.

Included with this soil in mapping were small areas of Goulding and Sierra soils and areas of a similar pale-brown, shallow soil that is less than 20 inches deep over weathered granite.

This Auberry soil is used mainly as range and wildlife habitat and for watershed. Capability unit VIIe-1(15, 18); Granitic range site; woodland suitability group, not assigned; wildlife group 5.

Auburn Series

The Auburn series consists of well-drained clay loams that are underlain by basic metavolcanic rock, mainly greenstone. These soils are on uplands in the north-central part of the survey area from Igo and Whiskeytown Lake to Ingot. Slopes range from 0 to 70 percent. Elevation ranges from 700 to 1,500 feet. The annual precipitation is 35 to 50 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and

the 28° F. growing season is 275 to 350 days. The vegetation is manzanita, blue oak, interior live oak, annual grasses, and Digger pine.

In a representative profile the surface layer is yellowish-red, medium acid clay loam about 5 inches thick. The subsoil is yellowish-red, medium acid gravelly clay loam. Decomposed greenish-gray, slightly acid metavolcanic rock mixed with gravelly clay loam is at a depth of about 27 inches.

Most areas of Auburn soils are used as range or dryland pasture. A few areas are used for crops and a few areas are suitable only for watershed and for wildlife habitat. Much of the early-day gold mining activity was on areas of these soils.

Representative profile of Auburn clay loam, 8 to 30 percent slopes, eroded, about 1,000 feet east-southeast of the center of sec. 8, T. 31 N., R. 5 W.:

Ap—0 to 5 inches, yellowish-red (5YR 4/6) clay loam, yellowish red (5YR 3/6) moist; weak, very coarse, subangular blocky structure; very hard, friable, nonsticky and slightly plastic; common very fine and few fine roots; many very fine tubular and interstitial pores and few fine tubular pores; medium acid; clear, smooth boundary.

B1—5 to 13 inches, yellowish-red (5YR 4/6) gravelly clay loam, yellowish red (5YR 3/6) moist; weak, medium, subangular blocky and moderate, medium, granular structure; hard, friable, slightly sticky and slightly plastic; common very fine roots and few fine roots; many very fine tubular and interstitial pores and few fine tubular pores; few thin clay films in pores; medium acid; gradual, smooth boundary.

B2—13 to 27 inches, yellowish-red (5YR 4/6) gravelly clay loam, yellowish red (5YR 3/6) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots and few fine roots; many very fine tubular and interstitial pores and few fine tubular pores; few thin clay films in pores; medium acid; gradual, smooth boundary.

C—27 inches, greenish-gray (5GY 6/1) decomposed basic metavolcanic rock mixed with gravelly clay loam; massive; few roots in cracks; continuous moderately thick clay films in cracks; slightly acid.

The A horizon ranges from 5 to 10 inches in thickness, from brown to yellowish red in color, from gravelly heavy loam or loam to gravelly clay loam or clay loam in texture, and from slightly acid to medium acid in reaction. The B horizon ranges from 7 to 22 inches in thickness, from reddish brown to reddish yellow or yellowish red in color, from clay loam to gravelly clay loam in texture, and from slightly acid to medium acid in reaction. Depth to basic metavolcanic rock is 12 to 32 inches. Stones cover 3 to 15 percent of the surface in places.

Auburn soils generally are near areas of Behemotosh, Boomer, Goulding, and Neuns soils.

Auburn loam, 0 to 8 percent slopes (AnB).—This soil has a profile similar to the one described as representative for the series, except that the surface layer is loam 5 to 10 inches thick. Permeability is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 2.5 to 6 inches. Weathered bedrock is at a depth of 15 to 32 inches.

Included with this soil in mapping were areas of a reddish-brown soil that is more than 32 inches deep over greenstone.

This Auburn soil is used mainly as dryland pasture. Small areas are used as irrigated pasture and for vineyards. Capability unit IVe–8(17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Auburn loam, 8 to 30 percent slopes (AnD).—This soil has a profile similar to the one described as representative for the series, except that the surface layer is loam that is 5 to 10 inches thick. Permeability is moderate. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 2.5 to 6 inches. Weathered bedrock is at a depth of 15 to 32 inches.

Included with this soil in mapping were small areas of Auberry soils and small areas of mine pits and piles of mine tailings.

This Auburn soil is used mainly as dryland pasture. Capability unit VIe–1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Auburn very stony loam, 8 to 30 percent slopes (ArD).—This soil has a profile similar to the one described as representative for the series, except that the surface layer is about 5 to 10 inches thick. Permeability is moderate. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 2.5 to 6 inches. Weathered bedrock is at a depth of 15 to 32 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were some areas of a soil that has a very slowly permeable clay subsoil over the parent rock. Also included were areas of other Auburn soils and areas of mine tailings and mine pits.

This Auburn soil is used mainly as range and wildlife habitat and for watershed. Capability unit VIs–1(15, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Auburn clay loam, 8 to 30 percent slopes, eroded (AsD2).—This soil has the profile described as representative for the series. Permeability is moderate. Runoff is medium to rapid, and the hazard of further erosion is moderate to high. Available water capacity is 2.5 to 6 inches. Weathered bedrock is at a depth of 15 to 32 inches.

Included with this soil in mapping were small areas of mine pits and tailings. Also included were areas of Boomer, Goulding, and Maymen soils.

This Auburn soil is used mainly as dryland pasture. Small areas are used as irrigated pasture. Capability unit VIe–1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Auburn very stony clay loam, 30 to 50 percent slopes, eroded (AtE2).—This soil has moderate permeability. Runoff is rapid, and the hazard of further erosion is high. Available water capacity is 2.5 to 6 inches. Depth to weathered bedrock is 15 to 32 inches. Stones cover 3 to 15 percent of the surface, and a few rock outcrops are also present.

Included with this soil in mapping were small areas of Stonyford soils and a reddish-brown, very stony clay loam soil that is more than 32 inches deep over greenstone.

This Auburn soil is used mainly as range and wildlife habitat and for watershed. Capability unit VIIs–1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Auburn very rocky clay loam, 50 to 70 percent slopes, eroded (AuF2).—This soil has moderate permeability. Runoff is very rapid, and the hazard of further erosion is very high. Available water capacity is 2 to 4 inches. Depth to weathered bedrock is 12 to 24 inches. Exposed bedrock outcrops and stones cover 10 to 25 percent of the surface.

Included with this soil in mapping were small areas of Stonyford soils and a shallow, yellowish-brown, rocky clay loam.

This Auburn soil is used as range and wildlife habitat and for watershed. Capability unit VIIs–1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Behemotosh Series

The Behemotosh series consists of well-drained soils that are underlain by rhyolitic stones and rock. These soils are on uplands along the north-central edge of the survey area near French Gulch, Keswick, and Ingot. Slopes range from 8 to 70 percent. Elevation ranges from 1,000 to 3,000 feet. The annual precipitation is 40 to 60 inches, and the average annual air temperature is about 54° F. The 32° F. growing season is 150 to 200 days, and the 28° F. growing season is 200 to 250 days. The vegetation is mixed conifers, oaks, and shrubs.

In a representative profile the surface layer is grayish-brown and light brownish-gray, medium acid loam and gravelly loam about 4 inches thick. The subsoil is very pale brown and reddish-yellow, medium acid gravelly loam and very cobbly light clay loam. The substratum of rhyolitic stones mixed with a small amount of soil material is at a depth of about 24 inches.

Behemotosh soils are used as woodland and wildlife habitat and for watershed.

Representative profile of Behemotosh very rocky loam, 50 to 70 percent slopes, eroded, on South Fork Mountain Road about ½ mile southwest of the Iron Mountain Mine, near the south line of sec. 34, T. 33 N., R. 6 W.:

O—½ inch to 0, litter and humus of conifers and oak.

A11—0 to 2 inches, grayish-brown (10YR 5/2) light loam, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots; common very fine interstitial pores; very few thin clay films; medium acid; abrupt, smooth boundary.

A12—2 to 4 inches, light brownish-gray (10YR 6/2) gravelly loam, dark brown (7.5YR 4/4) moist; moderate, medium, granular structure; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; common very fine interstitial pores; very few thin clay films; medium acid; abrupt, wavy boundary.

B1t—4 to 16 inches, very pale brown (10YR 7/4) gravelly loam, brown (7.5YR 5/4) moist; weak, coarse, granular structure; slightly hard, friable, nonsticky and slightly plastic; common fine and medium roots; common very fine interstitial pores; common thin clay films on ped faces and in pores; medium acid; diffuse, irregular boundary.

B2t—16 to 24 inches, reddish-yellow (7.5YR 7/6) very cobbly light clay loam, strong brown (7.5YR 5/6) moist; weak, fine and medium, subangular blocky structure; hard, friable, nonsticky and slightly plastic; few very fine and fine roots; common very fine and fine tubular and interstitial pores; few moderately thick and common thin clay films on ped faces and in pores; medium acid; diffuse, irregular boundary.

C—24 inches, rhyolite stones and a small amount of soil material; very few very fine and fine roots and common medium roots.

The A horizon ranges from 4 to 12 inches in thickness, from grayish brown to light brown or light brownish gray in color, from sandy loam to gravelly loam in texture, and from slightly acid to strongly acid in reaction. The B2t horizon ranges from 8 to 30 inches in thickness, from very pale brown to reddish yellow in color, from very gravelly to very cobbly heavy loam or clay loam in texture, and from medium acid to very strongly acid in reaction. The content of cobblestones or gravel is 30 to 50 percent in this horizon. Depth to the C horizon ranges from 18 to 52 inches. Stones cover 3 to 15 percent of the surface in places.

Behemotosh soils generally are near areas of Auburn, Boomer, Goulding, Kidd, and Neuns soils.

Behemotosh very stony loam, 8 to 30 percent slopes (BeD).—This soil has moderately slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 2 to 6 inches. Rhyolitic stones are at a depth of 18 to 52 inches. Stones cover about 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Boomer, Kidd, and Neuns soils.

This Behemotosh soil is used mainly as woodland and wildlife habitat and for watershed. Capability unit VIs–1 (22); range site, not assigned; woodland suitability group 7; wildlife group 8.

Behemotosh very stony loam, 30 to 50 percent slopes, eroded (BeE2).—This soil has moderately slow permeability. Runoff is rapid, and the hazard of further erosion is high. Available water capacity is 2.5 to 6 inches. The stony substratum is at a depth of 18 to 42 inches. Stones cover about 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Boomer, Kidd, and Neuns soils.

This Behemotosh soil is used as woodland and wildlife habitat and for watershed. Capability unit VIs–1(22); range site, not assigned; woodland suitability group 7; wildlife group 8.

Behemotosh very rocky loam, 50 to 70 percent slopes, eroded (BhF2).—This soil has the profile described as representative for the series. Permeability is moderately slow. Runoff is very rapid, and the hazard of further erosion is very high. Available water capacity is 3 to 5 inches. The stony substratum is at a depth of 24 to 42 inches. Stones cover 10 to 25 percent of the surface.

Included with this soil in mapping were small areas of Boomer, Kidd, and Neuns soils.

This Behemotosh soil is used as woodland and wildlife habitat and for watershed. Capability unit VIIs–1(22); range site, not assigned; woodland suitability group 7; wildlife group 8.

Boomer Series

The Boomer series consists of well-drained gravelly loams that are underlain by weathered metabasic rock, mainly greenstone. These soils are on uplands from the southwestern to the north-central parts of the survey area near Platina, French Gulch, Shasta, Keswick, Central Valley, Ingot, and Oak Run. Slopes range from 0 to 70 percent. Elevation ranges from 700 to 4,000 feet. The annual precipitation is 40 to 60 inches, and the average annual air temperature is about 54° F. The 32° F. growing season is 150 to 250 days, and the 28° F. growing season is 250 to 350 days. The vegetation is mixed conifers, shrubs, grasses, and oaks.

In a representative profile the surface layer is light-brown, medium acid gravelly loam about 3 inches thick. The subsoil, to a depth of about 11 inches, is reddish-yellow, medium acid gravelly sandy clay loam. Below this, the subsoil is red, medium acid gravelly clay loam, clay

loam, and silty clay loam. Red, medium acid, strongly weathered and fractured greenstone is at a depth of 45 inches.

The areas of Boomer soils are used as woodland and wildlife habitat and for watershed.

Representative profile of Boomer gravelly loam, 15 to 30 percent slopes, about 1 mile northwest of Whiskeytown Dam, sec. 27, T. 31 N., R 6 W.:

O—2 inches to 0, black oak, yellow pine, and manzanita litter and humus.

A1—0 to 3 inches, light-brown (7.5YR 6/4) gravelly loam, dark reddish brown (5YR 3/4) moist; weak, fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine tubular and interstitial pores and few fine tubular pores; medium acid; clear, smooth boundary.

B1—3 to 11 inches, reddish-yellow (5YR 6/6) gravelly sandy clay loam, yellowish red (5YR 4/6) moist; weak medium, subangular blocky structure; hard, firm, slightly sticky and plastic; many very fine roots and common fine and coarse roots; many very fine tubular and interstitial pores and few fine tubular pores; common moderately thick clay films in pores; medium acid; gradual, wavy boundary.

B2t—11 to 23 inches, red (2.5YR 4/6) gravelly clay loam, red (2.5YR 4/6) moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and plastic; common very fine and coarse roots; many very fine tubular and interstitial pores and few fine tubular pores; continuous moderately thick clay films on ped faces and in pores; medium acid; gradual, irregular boundary.

B31t—23 to 33 inches, red (2.5YR 4/6) clay loam, red (2.5YR 4/6) moist; weak, coarse, subangular blocky structure; hard, firm, slightly sticky and plastic; few fine and coarse roots; common very fine tubular pores; many moderately thick clay films on ped faces and in pores; reddish-yellow (7.5YR 6/6) rotten pebbles; medium acid; diffuse, irregular boundary.

B32t—33 to 45 inches, red (2.5YR 4/6) silty clay loam, red (2.5YR 4/6) moist; massive; slightly hard, firm, slightly sticky and plastic; few very fine and fine roots; common very fine tubular pores; common thick clay films; in pores; reddish-yellow (7.5YR 6/6) rotten pebbles; medium acid; diffuse, irregular boundary.

C—45 inches, red (2.5YR 4/6) strongly weathered greenstone, red (2.5YR 4/6) moist; massive; very few roots along fracture planes; no pores; few thick clay films along fracture planes; medium acid.

The A horizon ranges from 3 to 6 inches in thickness, from light brown to reddish brown in color, from gravelly heavy loam to gravelly clay loam in texture, and from slightly acid to strongly acid in reaction. The Bt horizon is 33 to 54 inches thick; is reddish yellow, yellowish red, or red in color; is gravelly clay loam to silty clay loam in texture; and is slightly acid to strongly acid in reaction. Depth to the C horizon is 40 to more than 60 inches. In severely eroded areas the soil is 20 to 40 inches deep over weathered parent rock.

Boomer soils generally are near areas of **Auburn, Chaix, Diamond Springs, Goulding,** and Neuns soils.

Boomer gravelly loam, 0 to 15 percent slopes (BkC).—This soil has moderately slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 7 to 10 inches. Weathered bedrock is at a depth of 40 to more than 60 inches.

Included with this soil in mapping were small areas of Goulding, Neuns, and Stonyford soils.

This Boomer soil is used as woodland. Small areas are used as irrigated pasture or for orchards or vineyards. Capability unit IIIe-1(22); range site, not assigned; woodland suitability group 4; wildlife group 8.

Boomer gravelly loam, 15 to 30 percent slopes (BkD).—This soil has the profile described as representative for the series. Permeability is moderately slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 7 to 10 inches. Weathered bedrock is at a depth of 40 to more than 60 inches.

Included with this soil in mapping were small areas of Goulding, Neuns, and Stonyford soils.

This Boomer soil is used mainly as woodland. Small areas are used as irrigated pasture and for orchards and vineyards. Capability unit IVe-1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Boomer gravelly loam, 30 to 50 percent slopes (BkE).—This soil has moderately slow permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 7 to 10 inches. Weathered bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping were small areas of Goulding, Neuns, and Stonyford soils.

This Boomer soil is used as woodland and wildlife habitat and for watershed. Capability unit VIe-1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Boomer very stony loam, 50 to 70 percent slopes (B.F).—This soil has moderately slow permeability. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 7 to 10 inches. Weathered bedrock is at a depth of 40 to 60 inches. Stones cover about 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Goulding, Neuns, and Stonyford soils.

This Boomer soil is used mainly as woodland and wildlife habitat and for watershed. Capability unit VIIs-1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Boomer very stony clay loam, 30 to 50 percent slopes, severely eroded (BoE3).—This soil has a profile similar to the one described as representative for the series, except that all of its original surface layer has been lost through erosion, and weathered bedrock is at a depth of only 20 to 40 inches. Runoff is rapid, and the hazard of further erosion is high. Available water capacity is 4 to 7 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were areas of Goulding, Neuns, and Stonyford soils.

This Boomer soil is used mainly as woodland and wildlife habitat and for watershed. Capability unit VIs-1(22); range site, not assigned; woodland suitability group 7; wildlife group 8.

Boomer very stony clay loam, 50 to 70 percent slopes, severely eroded (BoF3).—This soil has a profile similar to that described as representative for the series, except that all of its original surface layer has been lost through erosion, and weathered bedrock is at a depth of only 20 to 40 inches. Runoff is very rapid, and the hazard of further erosion is very high. Available water capacity is 4 to 7 inches. Stones cover about 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Goulding, Neuns, and Stonyford soils.

This Boomer soil is used mainly as woodland and wildlife habitat and for watershed. Capability unit VIIs-1 (22); range site, not assigned; woodland suitability group 7; wildlife group 8.

Chaix Series

The Chaix series consists of well-drained and somewhat excessively drained soils that are underlain by weathered granitic rocks. These soils are on uplands in the northwestern part of the survey area near Whiskeytown Lake, French Gulch, Shasta, Keswick, Ono, and Igo. Slopes range from 5 to 70 percent. Elevation ranges from 1,000 to 4,000 feet. The annual precipitation is 40 to 60 inches, and the average annual air temperature is about 55° F. The 32° F. growing season is 150 to 250 days, and the 28° F. growing season is 250 to 300 days. Vegetation is mixed conifers, shrubs, oaks, and grasses.

In a representative profile the surface layer is grayish-brown, neutral and medium acid sandy loam and coarse sandy loam about 9 inches thick. The subsoil is brown, medium acid heavy sandy loam. Decomposed granite is at a depth of about 26 inches.

The areas of Chaix soils are used as woodland and wildlife habitat and for watershed.

Representative profile of Chaix sandy loam, 30 to 50 percent slopes, on the Rainbow Lake road, about 4 miles northwest of Ono, near the W¼ corner of sec. 32, T. 31 N., R. 7 W.:

O—1 inch to 0, litter and humus; abrupt, smooth boundary.

A11—0 to 2 inches, grayish-brown (2.5Y 5/2) sandy loam, very dark gray (10YR 3/1) moist; moderate, fine, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and common fine roots; many fine interstitial pores; neutral; abrupt, smooth boundary.

A12—2 to 9 inches, grayish-brown (10YR 5/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine and common fine roots; many fine interstitial pores, common very fine tubular pores, and few fine, medium, and coarse tubular pores; medium acid; gradual, smooth boundary.

B21—9 to 17 inches, brown (10YR 5/3) heavy sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium roots and few very fine and coarse roots; many fine interstitial pores, common very fine tubular pores, and few fine, medium, and coarse tubular pores; medium acid; gradual, smooth boundary.

B22—17 to 26 inches, brown (10YR 5/3 heavy sandy loam, brown (10YR 4/3) moist; weak, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common medium roots and few very fine and fine roots; many fine interstitial pores, common very fine tubular pores, and few fine, medium, and coarse tubular pores; few thin clay films as bridges; medium acid; diffuse, irregular boundary.

C—26 inches, brown (10YR 5/3) decomposed granite; medium acid.

The A horizon ranges from 5 to 10 inches in thickness, from dark grayish brown to very pale brown in color, and from neutral to strongly acid in reaction. The content of gravel is 10 to 20 percent in this horizon in places. The B2 horizon ranges from 15 to 30 inches in thickness, from brown to pale yellow in color, from sandy loam to light sandy clay loam in texture, and from medium acid to strongly acid in reaction. The C horizon is at a depth of 20 to 40 inches and is strongly weathered granitic rock.

Chaix soils generally are near areas of Corbett, Diamond Springs, Holland, Kanaka, and Sierra soils.

Chaix coarse sandy loam, 30 to 50 percent slopes, severely eroded (CaE3). This soil has a profile similar to that described as representative for the series, except that its surface layer is pale brown coarse sandy loam. It is somewhat excessively drained and has moderately rapid permeability. Runoff is rapid, and the hazard of further erosion is high. Some areas are severely gullied or rilled. Available water capacity is 2 to 6 inches. Weathered granite is at a depth of 20 to 40 inches. The evidence of erosion is more apparent in the raw, pale-colored surface layer than in the depth to weathered granite.

Included with this soil in mapping were small areas of Holland, Kanaka, and Sierra soils and areas of soils that are more than 40 inches deep to weathered granite.

The Chaix soil is used as woodland and wildlife habitat and for watershed. Capability unit VIIe-1(22); range site, not assigned; woodland suitability group 7; wildlife group 8.

Chaix coarse sandy loam, 50 to 70 percent slopes, severely eroded (CaF3).—This soil has a profile similar to that described as representative for the series, except that it has a surface layer of pale-brown coarse sandy loam. It is somewhat excessively drained and has moderately rapid permeability. Runoff is very rapid, and the hazard of further erosion is very high. Some areas are severely rilled or gullied. Available water capacity is 2 to 6 inches. Weathered bedrock is at a depth of 20 to 40 inches. The evidence of erosion is more apparent in the raw pale-colored surface layer than in the depth to weathered bedrock.

Included with this soil in mapping were small areas of Holland, Kanaka, and Sierra soils.

This Chaix soil is used as woodland, for watershed, and as wildlife habitat. Capability unit VIIe-1(22); range site, not assigned; woodland suitability group 7; wildlife group 8.

Chaix sandy loam, 5 to 30 percent slopes, eroded (CbD2).—This soil is well drained and has moderately rapid permeability. Runoff is medium to rapid, and the hazard of further erosion is moderate to high. Available water capacity is 3 to 6 inches. Weathered bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping were small areas of Holland, Kanaka, and Sierra soils.

This Chaix soil is used mainly for watershed and as woodland and wildlife habitat. Capability unit VIe-1 (22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Chaix sandy loam, 30 to 50 percent slopes (CbE).—This soil has the profile described as representative for the series. It is well drained and has moderately rapid permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 3 to 6 inches. Weathered bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping were areas of Holland, Kanaka, and Sierra soils.

This Chaix soil is used mainly as woodland and wildlife habitat and for watershed. Capability unit VIIe-1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Chaix sandy loam, 50 to 70 percent slopes (CbF).—This soil is somewhat excessively drained and has moderately rapid permeability. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 3 to 6 inches. Weathered bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping were small areas of Holland, Kanaka, and Sierra soils.

This Chaix soil is used mainly as woodland and wildlife habitat and for watershed. Capability unit VIIe-1(22); range site, not assigned; woodland suitability group 6; wildlife group 6.

Churn Series

The Churn series consists of well-drained and moderately well drained soils that formed in alluvium from mixed sources. These soils are on low terraces and fans in the central part of the survey area along the Sacramento River; along Cottonwood, Cow, and Stillwater Creeks; and along tributaries of these streams. Slopes range from 0 to 8 percent. Elevation ranges from 500 to 1,000 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 65° F. The 32° F. growing season is 250 to 275 days, and the 28° F. growing season is 300 to 325 days. The vegetation is blue oak, valley oak, interior live oak, Digger pine, and annual grasses and forbs.

In a representative profile the surface layer is light yellowish-brown, medium acid gravelly loam about 9 inches thick. The upper part of the subsoil is light yellowish-brown, medium acid gravelly loam about 4 inches thick. The lower part of the subsoil is light yellowish-brown and strong-brown, medium acid gravelly clay loam that extends to a depth of more than 60 inches.

The areas of Churn soils are used for irrigated and dryland crops.

Representative profile of Churn gravelly loam, 0 to 3 percent slopes, 180 feet north and 1,220 feet east of the southwest corner of sec. 2, T. 29 N., R. 5 W.:

A1—0 to 9 inches, light yellowish-brown (10YR 6/4) gravelly loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine and few fine tubular pores; medium acid; gradual, smooth boundary.

B1—9 to 13 inches, light yellowish-brown (10YR 6/4) gravelly loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine and few fine tubular pores; common moderately thick clay films as bridges and in pores; medium acid; clear, smooth boundary.

B21t—13 to 29 inches, light yellowish-brown (10YR 6/4) gravelly clay loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, medium, and coarse roots; common very fine and fine tubular pores; many moderately thick clay films as bridges and in pores; medium acid; gradual, smooth boundary.

B22t—29 to 40 inches, light yellowish-brown (10YR 6/4) gravelly clay loam, reddish brown (5YR 4/4) moist; weak, coarse, angular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine, medium, and coarse roots; common very fine and fine tubular pores; many moderately thick clay films as bridges and many thin clay films in pores; medium acid; gradual smooth boundary.

B23t—40 to 60 inches, strong-brown (7.5YR 5/6) gravelly light clay loam, reddish brown (5YR 4/4) moist; strong, medium, angular blocky structure; hard, firm, slightly sticky and plastic; few fine and medium roots; few very fine and fine tubular pores; many moderately thick clay films as bridges and on ped faces and many thin clay films in pores; medium acid.

The A horizon ranges from 9 to 20 inches in thickness, from brown to light yellowish brown in color, from gravelly loam to loam in texture, and from medium acid to strongly acid in reaction. The B1 horizon is 2 to 6 inches thick. The B2t horizon ranges from 27 to more than 50 inches in thickness, from heavy loam to clay loam in texture, and from medium acid to strongly acid in reaction. In most places it is gravelly. The C horizon in most places is stratified gravelly sandy loam and loam. It is medium acid. In some areas the C horizon is consolidated alluvium and is at a depth of 36 to 60 inches.

Churn soils generally are near areas of Anderson, Honcut, Newtown, Perkins, Red Bluff, Reiff, and Tehama soils.

Churn loam, 0 to 3 percent slopes (CcA).—This soil has a profile similar to the one described as representative of the series, except that the content of gravel is less than 15 percent throughout the profile. It is well drained and has moderately slow permeability. Runoff is slow, and the hazard of erosion is none to slight. Available water capacity is 10 to 12 inches. Roots can penetrate to a depth of 60 inches.

Included with this soil in mapping were small areas of Honcut, Perkins, and Tehama soils.

This Churn soil is used for irrigated hay and as irrigated pasture and dryland pasture. It is also used, to a limited extent, for irrigated crops. Capability unit I-1(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Churn loam, 3 to 8 percent slopes (CcB).—This soil has a profile similar to the one described as representative for the series, except that the content of gravel is less than 15 percent throughout the profile. It is well drained and has moderately slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 10 to 12 inches. Roots can penetrate to a depth of 60 inches.

Included with this soil in mapping were small areas of Honcut, Perkins, and Tehama soils.

This Churn soil is used as irrigated pasture and for irrigated hay and dryland hay. It is also used, to a limited extent, for irrigated crops. Capability unit IIe-1(17, 18); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Churn loam, slightly wet, 0 to 3 percent slopes (CdA).—This soil has a profile similar to the one described as representative for the series, except that the content of gravel is less than 15 percent throughout the profile. This soil is moderately well drained, and a water table is at a depth of 4 to more than 5 feet for short periods. Permeability is moderately slow. Runoff water ponds on the surface or runs off very slowly. The hazard of erosion is none or slight. Available water capacity is 10 to 12 inches. This soil is more than 60 inches deep.

Included with this soil in mapping were small areas of Honcut, Perkins, and Tehama soils and Cobbly alluvial land, frequently flooded.

This Churn soil is used for irrigated hay and as irrigated pasture and dryland pasture. Small areas are used for irrigated crops. Because wetness is a limitation on this soil, alfalfa stands are short lived, and some tree crops are adversely affected in places. Capability unit IIw-2(17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Churn gravelly loam, 0 to 3 percent slopes (CeA).—This soil has the profile described as representative for the series. It is well drained and has moderately slow permeability. Runoff is slow, and the hazard of erosion is none

to slight. Available water capacity is 8 to 10 inches. Roots can penetrate to a depth of 60 inches. The content of gravel is 15 to 30 percent throughout the profile.

Included with this soil in mapping were small areas of Honcut, Perkins, and Tehama soils. Also included were areas of Cobbly alluvial land, frequently flooded, and areas of a similar soil that is slightly acid.

This Churn soil is used for irrigated hay and as irrigated pasture and dryland pasture. Small areas are used for irrigated row crops and orchards. Capability unit IIs-4 (17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Churn gravelly loam, 3 to 8 percent slopes (CeB).—This soil is well drained and has moderately slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 8 to 10 inches. Roots can penetrate to a depth of 60 inches. The content of gravel is 15 to 30 percent throughout the profile.

Included with this soil in mapping were small areas of Honcut, Perkins, and Tehama soils.

This Churn soil is used as dryland pasture and irrigated pasture. Capability unit IIe-1(17, 18); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Churn gravelly loam, deep, 0 to 3 percent slopes (CfA).—This soil is in narrow channeled valley bottoms. It is moderately well drained. This soil has a profile similar to the one described as representative for the series, except that consolidated alluvium is at a depth of 36 to 60 inches. Permeability and runoff are slow. The hazard of erosion is none to slight. Available water capacity is 5 to 10 inches. The content of gravel is 15 to 30 percent throughout the profile.

Included with this soil in mapping were small areas of Honcut, Perkins, and Tehama soils. Also included were areas of Cobbly alluvial land, frequently flooded.

This Churn soil is used as irrigated and dryland pasture. It is not suited to deep-rooted crops. Capability unit IIs-3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Churn gravelly loam, deep, 3 to 8 percent slopes (CfB).—This soil has a profile similar to the one described as representative for the series, except that consolidated alluvium is at a depth of 36 to 60 inches. This soil is well drained, and permeability is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 5 to 10 inches. The content of gravel is 15 to 30 percent throughout the profile.

Included with this soil in mapping were small areas of Honcut, Perkins, and Tehama soils.

This Churn soil is used as dryland and irrigated pasture. Capability unit IIe-3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Clough Series

The Clough series consists of moderately well drained soils that have a hardpan. The soils formed in old mixed alluvium of the Tehama Formation. They are on high terrace remnants west of Palo Cedro and Bella Vista and near Ono. Slopes are 3 to 8 percent. Elevation ranges from 500 to 1,000 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 200 to 300 days. The vegetation is annual grasses and forbs, blue oak, and manzanita.

In a representative profile the surface layer is brown, medium acid gravelly loam about 18 inches thick. The subsoil is light yellowish-brown, very strongly acid very gravelly clay and very gravelly clay loam about 11 inches thick. Below this layer is a strongly cemented hardpan about 15 inches thick. Below the hardpan is stratified mixed alluvium.

The areas of Clough soils are used as irrigated and dryland pasture.

Representative profile of Clough gravelly loam, 3 to 8 percent slopes, about 1¾ miles southwest of Bella Vista and 1,300 feet west of the southeast corner of sec. 13, T. 32 N., R. 4 W.:

A11—0 to 6 inches, brown (10YR 5/3) gravelly loam, dark brown (7.5YR 3/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine interstitial pores; medium acid; gradual, smooth boundary.

A12—6 to 14 inches, brown (7.5YR 5/4) gravelly loam, brown (7.5YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial and tubular pores; medium acid; clear, smooth boundary.

A3—14 to 18 inches, brown (7.5YR 5/4) gravelly heavy loam, brown (7.5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine interstitial and tubular pores; few thin clay films in pores; medium acid; abrupt, smooth boundary.

B2t—18 to 24 inches, light yellowish-brown (10YR 6/4) very gravelly clay, yellowish brown (10YR 5/4) moist; common, medium, prominent, white mottles; massive; very hard, firm, sticky and very plastic; very few very fine roots; few very fine tubular pores; continuous thick clay films as bridges; very strongly acid; clear, smooth boundary.

B3t—24 to 29 inches, light yellowish-brown (10YR 6/4) very gravelly clay, yellowish brown (10YR 5/4) moist; common, fine, distinct, reddish-yellow mottles; massive; hard, firm, sticky and plastic; few very fine tubular pores; continuous moderately thick clay films as bridges; very strongly acid; abrupt, smooth boundary.

C1m—29 to 44 inches, mixed light-gray and light yellowish-brown (10YR 7/1 and 6/4) strongly cemented hardpan; strongly cemented with opal; very strongly acid; diffuse, irregular boundary.

IIC2—44 to 60 inches, stratified old mixed alluvium of sand to clay texture.

The A horizon ranges from 12 to 20 inches in thickness, from brown to reddish yellow in color, and from medium acid to strongly acid in reaction. The B2t horizon ranges from 6 to 10 inches in thickness and from light brown to yellowish brown in color. The Cm horizon is a strongly cemented or indurated hardpan. Depth to the Cm horizon is 18 to 30 inches. The IIC2 horizon is very cobbly in places.

Clough soils generally are near areas of Igo, Newtown, Red Bluff, and Redding soils.

Clough gravelly loam, 3 to 8 percent slopes (CgB).—This is the only Clough soil mapped in the survey area. It has very slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 2 to 4 inches. Roots can penetrate to a depth of 18 to 30 inches to the hardpan.

Included with this soil in mapping were small areas of Newtown and Red Bluff soils.

This Clough soil is used as dryland pasture. If this soil is properly managed, it is suited to irrigated pasture. Capa-

bility unit IVe-8(17, 18); range site, not assigned: woodland suitability group, not assigned; wildlife group 2.

Cobbly Alluvial Land

Cobbly alluvial land (Ch) consists of very gravelly, very cobbly, or very stony, coarse-textured alluvium. It is on flood plains of the Sacramento River, and in some places it is along smaller streams near Round Mountain, Whitmore, and Big Bend. The vegetation is willow, alder, ceanothus, manzanita, annual grasses, and Digger pine.

This land type is excessively drained and has very rapid permeability. Runoff is very slow, and the hazard of erosion and deposition is moderate. Available water capacity is 2 to 4 inches. Roots can penetrate to a depth of 24 to 48 inches.

This land type is channeled, and slopes range from 1 to 5 percent. It is similar to Cobbly alluvial land, frequently flooded, except that it is not subject to annual flooding. Shasta Dam protects much of this land type from flooding. Where this land type is along small streams, it is subject to infrequent flooding for short periods.

The areas of Cobbly alluvial land can be used as dryland pasture. The potential for farming is limited. Capability unit IVs-0(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Cobbly alluvial land, frequently flooded (Ck) consists of very gravelly or very cobbly sandy alluvium. It is nearly level and is on flood plains and in old channels of larger streams throughout the central part of the survey area. The vegetation is a sparse to dense cover of annual grasses, Digger pine, cottonwood, sycamore, willow, and oaks.

Cobbly alluvial land, frequently flooded, is excessively drained, and it has very rapid permeability. Runoff is very slow, and the hazard of erosion is very severe. Available water capacity is 1 to 3 inches. Roots can penetrate to a depth of 4 to 24 inches. It is similar to Cobbly alluvial land, except that it is subject to annual flooding.

The areas of Cobbly alluvial land, frequently flooded, are used as range. Capability unit VIIw-1(17, 18); range site, not assigned; woodland suitability group, not assigned; wildlife group 9.

Cohasset Series

The Cohasset series consists of well-drained loams that are underlain by volcanic rocks. These soils are on uplands in the eastern part of the survey area from Shingletown and Viola to Oak Run and Big Bend. Slopes range from 0 to 75 percent. Elevation ranges from 2,500 to 5,000 feet. Annual precipitation is 35 to 60 inches, and the average annual air temperature is about 50° F. The 32° F. growing season is 150 to 200 days, and the 28° F. growing season is 200 to 300 days. Vegetation is mixed conifers.

In a representative profile the surface layer is dark reddish-brown and yellowish-red, slightly acid loam about 18 inches thick. The subsoil is yellowish-red, medium acid loam and gravelly clay loam that grades to yellowish-red, strongly acid very cobbly clay loam at a depth of about 53 inches.

Most of the acreage of these soils is used as woodland and wildlife habitat and for watershed. A few areas are used for field crops.

Representative profile of Cohasset loam, 0 to 30 percent slopes, at California Division of Forestry station near Big Wheels along State Route 44, 1,200 feet west of center of sec. 34, T. 31 N., R. 1 E.:

O1—5 inches to 2, pine needles and fresh litter.

O2—2 inches to 0, slightly acid decomposing organic material.

A11—0 to 7 inches, dark reddish-brown (5YR 3/4) loam, dark red (2.5YR 3/4) moist; strong, fine, granular structure; soft, very friable, nonsticky and nonplastic; common fine and coarse roots and many medium roots; many very fine interstitial pores; many concretions 1 to 6 millimeters in diameter; slightly acid; gradual, smooth boundary.

A12—7 to 18 inches, yellowish-red (5YR 4/6) loam, dark red (2.5YR 3/4) moist; strong, fine, granular structure; slightly hard, very friable, nonsticky and slightly plastic; few fine roots and many medium and coarse roots; many very fine interstitial pores; many concretions 1 to 6 millimeters in diameter; slightly acid; gradual, smooth boundary.

B1t—18 to 27 inches, yellowish-red (5YR 4/6) heavy loam, dark red (2.5YR 3/4) moist; moderate, fine, granular structure; slightly hard, very friable, nonsticky and slightly plastic; few fine and coarse roots and many medium roots; many very fine interstitial pores; many concretions 1 to 6 millimeters in diameter; medium acid; gradual, smooth boundary.

B21t—21 to 37 inches, yellowish-red (5YR 4/6) gravelly clay loam, dark red (5YR 3/6) moist; weak, fine and medium, granular structure; hard, friable, slightly sticky and plastic; few fine roots and common medium roots; few fine and medium tubular pores and common very fine interstitial pores; few thin clay films in pores; medium acid; gradual, smooth boundary.

B22t—37 to 53 inches, yellowish-red (5YR 4/6) gravelly clay loam, yellowish red (5YR 3/6) moist; massive; hard, firm, slightly sticky and plastic; few fine roots and common medium roots; few fine tubular pores and common very fine interstitial pores; few thin clay films in pores; medium acid; gradual, smooth boundary.

B3t—53 to 68 inches, yellowish-red (5YR 5/6) very cobbly clay loam, yellowish red (5YR 3/6) moist; massive; hard, firm, slightly sticky and plastic; few fine and medium roots; many very fine interstitial pores; very few thin clay films in pores; strongly acid.

The A horizon ranges from 8 to 24 inches in thickness, from dark reddish brown to yellowish brown or yellowish red in color, and from slightly acid to strongly acid in reaction. The B1t horizon is 4 to 10 inches thick. The B2t horizon ranges from 16 to more than 45 inches in thickness, from reddish yellow to yellowish red in color, from gravelly loam to clay loam in texture, and from medium acid to very strongly acid in reaction. The B3t horizon is 6 to 16 inches thick. The content of rock fragments increases with depth. Weathered andesite bedrock generally is at a depth of 48 to more than 60 inches, but it is at a depth of 24 to 48 inches in some places. The B1t and B3t horizons are absent in places where depth to weathered andesite bedrock is less than 48 inches.

Cohasset soils generally are near areas of Aiken, Kilarc, Lyonsville, McCarthy, Nannny, Sites, Supan, and Toomes soils.

Cohasset loam, 0 to 30 percent slopes (ClD).—This soil has the profile described as representative for the series. Permeability is moderate. Runoff is slow to rapid, and the hazard of erosion is slight to high. Available water capacity is 9 to 12 inches. Weathered andesite bedrock is at a depth of more than 60 inches.

Included with this soil in mapping were small areas of Aiken, Lyonsville, McCarthy, and Nanny soils.

This Cohasset soil is used mainly as woodland. At elevations of less than 4,000 feet it is suited to irrigated pasture and to orchards. Capability unit IVe-1(22); range site, not assigned; woodland suitability group 2; wildlife group 8.

Cohasset stony loam, 0 to 30 percent slopes (CmD).—This soil has moderate permeability. Runoff is slow to rapid, and the hazard of erosion is slight to high. Available water capacity is 7 to 9 inches. Depth to weathered andesite bedrock is 48 to more than 60 inches. Stones cover 1 to 3 percent of the surface, and the content of stones is about 15 to 25 percent throughout the profile.

Included with this soil in mapping were areas of a similar soil that has weathered rock at a depth of 36 to 48 inches. Also included were areas of Aiken, Lyonsville, McCarthy, and Nanny soils.

This Cohasset soil is used as woodland. Capability unit IVe–7(22); range site, not assigned; woodland suitability group 2; wildlife group 8.

Cohasset stony loam, 30 to 50 percent slopes (CmE).—This soil has moderate permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 7 to 9 inches. Weathered andesite bedrock is at a depth of 48 to 60 inches. Stones cover 1 to 5 percent of the surface, and the content of stones is about 15 to 25 percent throughout the profile.

Included with this soil in mapping were small areas of a similar soil that has weathered bedrock at a depth of about 26 to 48 inches. Also included were areas of Aiken, Lyonsville, McCarthy, and Nanny soils.

This Cohasset soil is used as woodland, for watershed, and as wildlife habitat. Capability unit VIe–1(22); range site, not assigned; woodland suitability group 3; wildlife group 8.

Cohasset very stony loam, 50 to 70 percent slopes (CnF).—This soil has moderate permeability. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 5 to 7 inches. Weathered andesite bedrock is at a depth of 48 to more than 60 inches. Stones cover 3 to 15 percent of the surface, and the content of stones is about 20 to 50 percent throughout the profile.

Included with this soil in mapping were small areas of a similar soil that has weathered bedrock at a depth of about 30 to 48 inches. Also included were areas of Aiken, Lyonsville, McCarthy, and Nanny soils.

This Cohasset soil is used as woodland, for watershed, and as wildlife habitat. Capability unit VIIs–1(22); range site, not assigned; woodland suitability group 3; wildlife group 8.

Cohasset very stony loam, moderately deep, 8 to 50 percent slopes (CoE).—This soil has moderate permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Weathered andesite bedrock is at a depth of 24 to 48 inches. Stones cover 3 to 15 percent of the surface, and the content of stones is about 20 to 50 percent throughout the profile.

Included with this soil in mapping were areas of Aiken, Lyonsville, McCarthy, and Nanny soils.

This Cohasset soil is used for watershed and as woodland and wildlife habitat. Capability unit VIs–1(22); range site, not assigned; woodland suitability group 7; wildlife group 8.

Cohasset-Aiken stony loams, 0 to 30 percent slopes (CpD).—About 60 percent of this complex is Cohasset stony loam, 0 to 30 percent slopes, and about 40 percent is Aiken stony loam, 0 to 30 percent slopes. The Cohasset and the Aiken soil each has a profile similar to that described as representative for its respective series.

The Cohasset soil has moderate permeability. Available water capacity is 6 to 9 inches. Weathered bedrock is at a depth of 48 to 60 inches. Stones cover 1 to 3 percent of the surface, and the content of stones is about 10 to 25 percent throughout the profile.

The Aiken soil has moderately slow permeability. Available water capacity is 7 to 9 inches. Weathered bedrock is at a depth of more than 60 inches. Stones cover 1 to 3 percent of the surface, and the content of stones is about 10 to 20 percent throughout the profile.

Runoff is medium to rapid on the soils of this unit. The hazard of erosion is moderate to high.

The areas of these soils are used mainly as woodland. Small areas are used as irrigated pasture and for orchards. Capability unit IVe–7(22); range site, not assigned; woodland suitability group 2; wildlife group 8.

Cohasset-McCarthy complex, 0 to 30 percent slopes (CrD).—About 60 percent of this unit is Cohasset stony loam, 0 to 30 percent slopes, and 40 percent is McCarthy stony sandy loam, 0 to 30 percent slopes.

The Cohasset soil has a profile similar to that described as representative for the Cohasset series. It has moderate permeability. Available water capacity is 6 to 9 inches. Weathered bedrock is at a depth of 48 to 60 inches. Stones cover about 1 to 3 percent of the surface, and the content of stones is about 10 to 25 percent throughout the profile.

The McCarthy soil has the profile described as representative for the McCarthy series. Permeability is moderately rapid in the McCarthy soil. Available water capacity is 3 to 6 inches. Hard weathered bedrock is at a depth of 40 to 60 inches. Stones cover about 1 to 3 percent of the surface.

Runoff is medium to rapid on the soils of this unit. The hazard of erosion is moderate to high.

The areas of these soils are used for watershed and as woodland and wildlife habitat. Capability unit VIe–1(22); range site, not assigned; woodland suitability group 2; wildlife group 8.

Cohasset-McCarthy complex, 30 to 50 percent slopes (CrE).—About 60 percent of this unit is Cohasset stony loam, 30 to 50 percent slopes, and about 40 percent is McCarthy very stony sandy loam, 30 to 50 percent slopes. Each of these soils has a profile similar to that described as representative for its respective series.

The Cohasset soil has moderate permeability. Available water capacity is 6 to 9 inches. Weathered bedrock is at a depth of 48 to 60 inches. Stones cover about 1 to 3 percent of the surface, and the content of stones is about 10 to 25 percent throughout the profile.

The McCarthy soil has moderately rapid permeability. Available water capacity is 3 to 6 inches. Hard weathered bedrock is at a depth of 40 to 60 inches. Stones cover about 3 to 15 percent of the surface.

Runoff is rapid on the soils of this unit. The hazard of erosion is high.

The areas of these soils are used for watershed and as woodland and wildlife habitat. Capability unit VIs–1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Cohasset-McCarthy complex, 50 to 75 percent slopes (CrG).—About 60 percent of this unit is Cohasset very stony loam, 50 to 75 percent slopes, and about 40 percent is McCarthy very stony loam, 50 to 75 percent slopes. Each of these soils has a profile similar to that described as representative for its respective series.

The Cohasset soil has moderate permeability. Available water capacity is 5 to 7 inches. Weathered bedrock is at a depth of 48 to 60 inches. Stones cover about 3 to 15 percent of the surface, and the content of stones is 20 to 50 percent throughout the profile.

The McCarthy soil has moderately rapid permeability. Available water capacity is 3 to 6 inches. Hard weathered bedrock is at a depth of 40 to 60 inches. Stones cover about 3 to 15 percent of the surface.

Runoff is very rapid on the soils of this unit. The hazard of erosion is very high.

The areas of the soils of this complex are used for watershed and as woodland and wildlife habitat. Capability unit VIIs–1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Colluvial Land

Colluvial land (CsF) consists of heterogenous deposits of soil material that contains 25 to 90 percent gravel and stones that accumulate at the base of steep slopes by gravity. It is unstable, and the surface is subject to movement. Colluvial land generally is in long narrow tracts in the mountainous parts of Shasta County Area. The vegetation is similar to that on adjacent soils, but more Canyon live oak and Douglas-fir grow on this land type than on adjacent soils.

Colluvial land ranges from shallow to very deep over rock or compacted colluvium. It is excessively drained, and it has moderate permeability. Runoff is rapid, and the hazard of erosion is very high. Available water capacity is variable.

The areas of Colluvial land are used as woodland and for water supply. Capability unit VIIs–1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Cone Series

The Cone series consists of well-drained and somewhat excessively drained soils that formed in material weathered from volcanic cinders. These soils are on volcanic cinder cones in the eastern part of the survey area near Black Butte, Sugar Pine Mountain, and Latour State Forest. Slopes range from 3 to 60 percent. Elevation ranges from 2,000 to 4,000 feet. The annual precipitation is 35 to 45 inches, and the average annual air temperature is about 55° F. The 32° F. growing season is 100 to 225 days, and the 28° F. growing season is 150 to 300 days. The vegetation is ponderosa pine, black oak, ceanothus, redbud, and annual and perennial grasses.

In a representative profile the surface layer is dark grayish-brown, neutral gravelly loam about 7 inches thick. The subsoil is yellowish-brown, neutral gravelly loam. It is underlain, at a depth of about 33 inches, by dark yellowish-brown, neutral gravelly heavy loam. Weathered and unweathered volcanic cinders are at a depth of about 58 inches.

The areas of Cone soils are used as woodland. The wooded areas have limited use for grazing. They are also used for irrigated hay, as pasture, for orchards, and for watershed.

Representative profile of Cone gravelly loam, 3 to 15 percent slopes, on the north side of Black Butte, 400 feet west of the S¼ corner of sec. 8, T. 30 N., R. 1 W.:

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (7.5YR 2.2) moist; moderate, fine, crumb structure; soft, very friable, nonsticky and slighty plastic; many very fine roots and few fine roots; many very fine interstitial and tubular pores; neutral; clear, smooth boundary.

B2—7 to 33 inches, yellowish-brown (10YR 5/4) gravelly loam, dark brown (7.5YR 3/2) moist; weak, fine, crumb structure; soft, very friable, nonsticky and slightly plastic; common very fine, medium, and coarse roots; many very fine interstitial pores and common fine tubular pores; neutral; gradual, smooth boundary.

C1—33 to 58 inches, dark yellowish-brown (10YR 4/4) gravelly heavy loam, dark brown (7.5YR 3/2) moist; massive; slightly hard, friable, nonsticky and slightly plastic; few very fine roots and common fine and medium roots; many very fine interstitial pores and few fine tubular pores; neutral; clear, irregular boundary.

C2—58 inches, mixed black unweathered and brown partially weathered cinders; stratified; individual pieces generally not more than one-half inch in diameter; neutral.

The A horizon ranges from 4 to 10 inches in thickness, from dark grayish brown to dark yellowish brown in color, and from medium acid to neutral in reaction. The B2 horizon ranges from 16 to 50 inches in thickness, from dark yellowish brown to reddish yellow in color, from gravelly loam to very gravelly loam in texture, and from slightly acid to neutral in reaction. The C1 horizon ranges from 4 to 30 inches in thickness, from dark yellowish brown to brownish yellow in color, from gravelly loam to gravel (cinders) in texture, and from medium acid to neutral in reaction. Depth to the C2 horizon ranges from 24 to more than 60 inches. Stones cover from none to 15 percent of the surface.

Cone soils generally are near areas of Cohasset, Guenoc, and Toomes soils.

Cone gravelly loam, 3 to 15 percent slopes (CfC).—This soil has the profile described as representative for the series. It is well drained and has rapid permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 6.5 to 9 inches. Cindery material is at a depth of 50 to 60 inches.

Included with this soil in mapping were small areas of Cohasset, Guenoc, and Toomes soils.

This Cone soil is used as woodland or for limited grazing. At elevations below about 2,800 feet, the soil is suited to irrigated hay, pasture, and orchards. Capability unit IIIe–1(22); range site, not assigned; woodland suitability group 4; wildlife group 8.

Cone gravelly loam, 15 to 30 percent slopes (CfD).—This soil is well drained and has rapid permeability. Runoff is medium, and the hazard of erosion is moderate. Available water capacity is 4.5 to 9 inches. Cindery material is at a depth of 36 to 60 inches.

Included with this soil in mapping were areas of Cohasset, Guenoc, and Toomes soils.

This Cone soil is used as woodland and for limited grazing. At elevations below about 2,800 feet, the soil is suited to irrigated hay, pasture, and orchards. Capability unit IVe–1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Cone stony loam, 3 to 30 percent slopes (CuD).—This soil is well drained and has rapid permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 4.5 to 9 inches. Cindery material is at a depth of 36 to 60 inches. Stones cover 1 to 3 percent of the surface.

Included with this soil in mapping were small areas of Cohasset, Guenoc, and Toomes soils.

This Cone soil is used as woodland and for limited grazing. Capability unit IVe-7(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Cone very stony loam, 30 to 50 percent slopes (CvE).—This soil is somewhat excessively drained and has rapid permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 4.5 to 9 inches. Cindery material is at a depth of 36 to 60 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Cohasset, Guenoc, and Toomes soils.

This Cone soil is used mainly as woodland and for limited grazing. Capability unit VIs-1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Cone very stony loam, moderately deep, 15 to 60 percent slopes (CwF).—This soil is somewhat excessively drained and has rapid permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 3 to 7 inches. Cindery material is at a depth of 24 to 48 inches.

Included with this soil in mapping were small areas of Cohasset, Guenoc, and Toomes soils.

This Cone soil is used as woodland and for limited grazing. Capability unit VIIs-1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Corbett Series

The Corbett series consists of somewhat excessively drained and excessively drained soils that are underlain by weathered granitic rocks. These soils are on uplands in the western part of the survey area between Ono and French Gulch. Slopes range from 15 to 80 percent. Elevation ranges from 3,000 to 6,500 feet. The annual precipitation is 30 to 50 inches, and the average annual air temperature is about 45° F. The 32° F. growing season is 100 to 150 days, and the 28° F. growing season is 125 to 175 days. The vegetation is mixed conifers, oaks, and shrubs.

In a representative profile the surface layer is grayish-brown, slightly acid loamy coarse sand about 8 inches thick. Below this layer is light-gray, slightly acid and medium acid loamy coarse sand. Weathered granite is at a depth of 24 inches.

The areas of Corbett soils are used as woodland and wildlife habitat and for watershed.

Representative profile of Corbet loamy coarse sand, 50 to 80 percent slopes, about 6½ miles southwest of French Gulch and ½ mile east of State Route 299 on the Bully Choop road in NW¼ sec. 13, T. 32 N., R. 8 W.:

O—½inch to 0, litter and humus layer, black (2.5Y 2/0) dry or moist; slightly acid; abrupt, smooth boundary.

A1—0 to 8 inches, grayish-brown (2.5Y 5/2) loamy coarse sand, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable, nonsticky and nonplastic; common fine and medium roots; slightly acid; abrupt, wavy boundary.

C1—8 to 16 inches, light-gray (2.5Y 7/2) loamy coarse sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; common fine and medium roots; slightly acid; abrupt, smooth boundary.

C2 16 to 24 inches, light-gray (2.5Y 7/2) loamy coarse sand, brown (10YR 5/3) moist; massive; soft, very friable, nonsticky and nonplastic; many medium and coarse roots; medium acid; gradual, wavy boundary.

C3 24 inches, weathered granitic rock.

The A horizon ranges from 4 to 8 inches in thickness, from dark grayish brown or grayish brown to light gray or pale brown in color where severely eroded, and from slightly acid to strongly acid in reaction. Where coniferous vegetation is dense, an O horizon is as much as 3 inches thick. The combined thickness of the C1 and C2 horizons is 15 to 32 inches. The C1 and C2 horizons range from light gray to pale brown in color, from loamy sand to loamy coarse sand in texture, and from slightly acid to strongly acid in reaction. The C3 horizon is very strongly weathered granitic rock. Depth to this horizon is 18 to 40 inches.

Corbett soils generally are near areas of Chaix and Holland soils.

Corbett loamy coarse sand, 15 to 50 percent slopes (CxE).—This soil is somewhat excessively drained and has rapid permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 2 to 4 inches. Weathered bedrock is at a depth of 24 to 40 inches.

Included with this soil in mapping were a few moderately large areas where weathered bedrock is at a depth of 40 to 60 inches. Also included were small areas of Chaix and Holland soils.

This Corbett soil is used as woodland and for watershed. Capability unit VIe-1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Corbett loamy coarse sand, 30 to 70 percent slopes, severely eroded (CxF3).—This soil has a profile similar to that described as representative for the series, except that it is severely eroded and has a pale-brown or light-gray surface layer. It is excessively drained and has rapid permeability. Runoff is rapid to very rapid, and the hazard of further erosion is high to very high. Available water capacity is 1.5 to 3 inches. Weathered bedrock is at a depth of 18 to 30 inches.

Included with this soil in mapping were fairly large areas where weathered bedrock is at a depth of more than 30 inches. Also included were small areas of Chaix and Holland soils.

This Corbett soil is used as woodland and for watershed. Capability unit VIIe-1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Corbett loamy coarse sand, 50 to 80 percent slopes (CxG).—This soil has the profile described as representative for the series. It is excessively drained and has rapid permeability. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 2 to 4 inches. Weathered bedrock is at a depth of 24 to 40 inches.

Included with this soil in mapping were areas where weathered bedrock is at a depth of 40 to more than 60 inches. Also included were small areas of Chaix soils.

This Corbett soil is used as woodland and for watershed. Capability unit VIIe-1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Corbett very rocky loamy coarse sand, 30 to 80 percent slopes (CyG).—This soil is excessively drained and has rapid permeability. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Available water capacity is 2 to 4 inches. Weathered bedrock is at a depth of 24 to 40 inches. Exposed bedrock outcrops cover 10 to 25 percent of the surface.

Included with this soil in mapping were fairly large areas where weathered bedrock is at a depth of 40 to more than 60 inches. Also included were small areas of Chaix soils.

This Corbett soil is used for watershed and as woodland. Capability unit VIIs-1(22); range site, not assigned; woodland suitability group 7; wildlife group 8.

Diamond Springs Series

The Diamond Springs series consists of well-drained soils that are underlain by granitic or light-colored metavolcanic rocks. These soils are on uplands near Shasta, Keswick, and Ingot. Slopes range from 8 to 50 percent. Elevation ranges from 1,000 to 2,000 feet. The annual precipitation is 40 to 50 inches, and the average annual air temperature is about 55° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 225 to 300 days. The vegetation is manzanita, toyon, black oak, interior live oak, ponderosa pine, and knobcone pine.

In a representative profile the surface layer is light brownish-gray and pale-brown, strongly acid very stony sandy loam and sandy loam about 10 inches thick. The upper 5 inches of the subsoil is pink, strongly acid sandy loam, and the lower 24 inches is reddish-yellow and yellowish-red, strongly acid sandy clay loam and sandy loam. The substratum is variably colored, strongly acid sandy loam. Strongly weathered metadacite is at a depth of about 54 inches.

The areas of these soils are used as woodland and wildlife habitat and for watershed.

Representative profile of Diamond Springs very stony sandy loam, 8 to 30 percent slopes, eroded, about 1.2 miles east of Shasta on State Highway 299.

Ap—0 to 3 inches, light brownish-gray (10YR 6/2) very stony sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; soft, very friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine interstitial pores; strongly acid; abrupt, smooth boundary.

A3—3 to 10 inches, pale-brown (10YR 6/3) sandy loam, brown (7.5YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and medium roots and few fine roots; common very fine and medium tubular pores and many very fine interstitial pores; strongly acid; clear, smooth boundary.

B1—10 to 15 inches, pink (7.5YR 6/4) sandy loam, brown (7.5YR 4/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common very fine and few fine roots; common very fine tubular pores and many very fine interstitial and few fine tubular pores; few thin clay bridges; strongly acid; clear, smooth boundary.

B2t—15 to 29 inches, reddish-yellow (7.5YR 7/6) and yellowish-red (5YR 5/8) sandy clay loam, strong brown (7.5YR 5/6) moist; weak, fine, angular blocky structure; hard, friable, sticky and plastic; few very fine and fine roots and common medium roots; many very fine interstitial and tubular pores and few fine interstitial and tubular pores; common moderately thick clay bridges and few thin clay films in pores; strongly acid; gradual, wavy boundary.

B3—29 to 39 inches, yellowish-red (5YR 5/8) and reddish-yellow (7.5YR 7/6) sandy loam, strong brown (7.5YR 5/6) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; many very fine tubular pores and common very fine interstitial pores; common moderately thick clay bridges in pores; strongly acid; gradual, wavy boundary.

C1—39 to 54 inches, reddish-yellow, very pale brown, and pale-brown (7.5YR 6/6, 10YR 8/4, 6/3) light sandy loam, yellowish brown (10YR 5/6) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; few very fine and medium roots; many very fine interstitial pores; few moderately thick clay bridges in pores and along fracture planes; strongly acid; gradual, irregular boundary.

C2—54 inches, weathered metadacite.

The A horizon ranges from 7 to 13 inches in thickness, from light brownish gray or pale brown to yellowish red in color, and from medium acid to very strongly acid in reaction. The B horizon ranges from 7 to 35 inches in thickness, from pink to light brown or yellowish red to reddish yellow in color, and from medium acid to strongly acid in reaction. The C1 horizon is 6 to 20 inches thick. Well-weathered metadacite rock is at a depth of 20 to 60 inches. Much of this soil is deeper than the Diamond Springs soils recognized elsewhere in California.

Diamond Springs soils generally are near areas of Auburn, Chaix, Goulding, and Kanaka soils.

Diamond Springs very stony sandy loam, 8 to 30 percent slopes, eroded (DfD2).—The soil has the profile described as representative for the series. Permeability is moderate. Runoff is medium to rapid, and the hazard of further erosion is moderate to high. Available water capacity is 3 to 8 inches. Weathered bedrock is at a depth of 24 to 60 inches. Stones and rock outcrops cover 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Kanaka soils.

This Diamond Springs soil is used as woodland and wildlife habitat and for watershed. Capability unit VIs-1(22); range site, not assigned; woodland suitability group 7; wildlife group 8.

Diamond Springs very rocky sandy loam, 30 to 50 percent slopes eroded (DfD2).—This soil has the profile de- permeability. Runoff is rapid, and the hazard of further erosion is high. Available water capacity is 3 to 8 inches. Weathered bedrock is at a depth of 24 to 60 inches. Exposed bedrock outcrops cover 5 to 20 percent of the surface.

Included with this soil in mapping were areas of Aiken, Goulding, and Kanaka soils.

This Diamond Springs soil is used as woodland and wildlife habitat and for watershed. Capability unit VIIs-1(22); range site, not assigned; woodland suitability group 7; wildlife group 8.

Diamond Springs very rocky sandy loam, 30 to 50 percent slopes, severely eroded (DgE3).—This soil has moderate permeability. Runoff is rapid, and the hazard of further erosion is high. Available water capacity is 2.5 to 4 inches. Weathered bedrock is at a depth of 20 to 30 inches. Exposed bedrock outcrops cover 5 to 20 percent of the surface.

Included with this soil in mapping were small areas of Aiken, Goulding, and Kanaka soils.

This Diamond Springs soil is used mainly for watershed and as wildlife habitat. It has limited use as woodland. Capability unit VIIs-1(22); range site, not assigned; woodland suitability group 7; wildlife group 8.

Forward Series

The Forward series consists of well-drained soils that are underlain by rhyolitic tuff that contains very few coarse fragments. These soils are on uplands in the southeastern corner of the survey area near Battle Creek. Slopes range from 0 to 50 percent. Elevation ranges from 2,000 to 4,000 feet. The annual precipitation is 30 to 50 inches, and the average annual air temperature is about 50° F. The 32° F. growing season is 150 to 200 days, and the 28° F. growing season is 200 to 300 days. The vegetation is

mixed conifers, black oak, squaw carpet, and greenleaf manzanita.

In a representative profile the surface layer is light brownish-gray, medium acid sandy loam about 3 inches thick. The subsoil is pale-brown, medium acid sandy loam about 8 inches thick. The substratum is very pale brown, slightly acid loamy sand. Weakly consolidated rhyolite tuff is at a depth of 22 inches.

Most areas of Forward soils are used as woodland and wildlife habitat and for watershed. Small areas are used for crops or orchards.

Representative profile of Forward sandy loam, 5 to 30 percent slopes, on a logging road one-half mile south of Canyon Creek and 5 miles east of Manton, Tehama County, 800 feet east and 800 feet north of the southwest corner of sec. 16, T. 30 N., R. 2 E.:

A1—0 to 3 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak, medium, granular structure; soft, very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; few very fine and fine tubular pores; medium acid; abrupt, smooth boundary.

B2—3 to 11 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; few very fine, fine, and medium tubular pores; medium acid; gradual, smooth boundary.

C1—11 to 22 inches, very pale brown (10YR 7/3) loamy sand, brown (10YR 5/3) moist; massive; slightly hard, very friable, nonsticky and nonplastic; very few fine, medium, and coarse roots; slightly acid; very abrupt, wavy boundary.

C2—22 inches, very pale brown (10YR 7/3) weakly consolidated rhyolite tuff; some gravel-size and few cobblestone-size fragments of pumice and andesite.

The A horizon ranges from 3 to 7 inches in thickness, from dark grayish brown to light brownish gray or light yellowish brown in color, and from slightly acid to medium acid in reaction. Where coniferous vegetation is dense, an O horizon is as much as 2 inches thick. The B2 horizon ranges from 6 to 18 inches in thickness, from light gray or pale brown to strong brown in color, and from medium acid to strongly acid in reaction. The C1 horizon ranges from 11 to 15 inches in thickness, from light gray to very pale brown in color, and from slightly acid to strongly acid in reaction. Bedrock of weakly consolidated rhyolitic tuff is at a depth of 20 to 36 inches. In places weakly consolidated rhyolitic tuff is at a depth of 36 to 48 inches, which is deeper than that for Forward soils recognized elsewhere in California.

Forward soils generally are near areas of Aiken, Cohasset, McCarthy, and Nanny soils.

Forward sandy loam, 5 to 30 percent slopes (FaD).—This soil has the profile described as representative for the series. Permeability is moderately rapid. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 2 to 4 inches. Tuff bedrock is at a depth of 20 to 36 inches.

Included with this soil in mapping were areas of Cohasset soils.

This Forward soil is used as woodland. Capability unit VIe–1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Forward sandy loam, 30 to 50 percent slopes (FaE).—This soil has moderately rapid permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 2 to 4 inches. Weakly consolidated tuff bedrock is at a depth of 20 to 36 inches.

Included with this soil in mapping were areas where cemented tuff is at a depth of 12 to 20 inches. Also included were areas of Aiken, Cohasset, and Nanny soils.

This Forward soil is used as woodland and wildlife habitat and for watershed. Capability unit VIIe–1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Forward sandy loam, deep, 0 to 30 percent slopes (FdD).—This soil has moderately rapid permeability. Runoff is slow to rapid, and the hazard of erosion is slight to high. Available water capacity is 3 to 5 inches. Weakly cemented tuff bedrock is at a depth of 36 to 48 inches.

Included with this soil in mapping were small areas of Aiken, Cohasset, and Nanny soils.

This Forward soil is used mainly as woodland. It is suited to irrigated pasture and orchards if water is available. Capability unit IVe–1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Gaviota Series

The Gaviota series consists of well-drained and somewhat excessively drained soils that are underlain by sandstone or conglomerate. These soils are on uplands in widely separated parts of the survey area. They are north of Redding, east of Millville, north of Bella Vista, and south of Ono. Slopes range from 0 to 50 percent. Elevation ranges from 600 to 1,000 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 60° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 300 to 350 days. The vegetation is annual grasses, blue oak, interior live oak, and Digger pine.

In a representative profile the surface layer is yellowish-brown, medium acid and slightly acid sandy loam about 17 inches thick. It is underlain by hard sandstone.

The areas of Gaviota soils are used as pasture, range, and wildlife habitat and for watershed.

Representative profile of Gaviota very rocky sandy loam, 0 to 30 percent slopes, 2 miles north of Bella Vista and 800 feet northwest of the southeast corner of sec. 31, T. 33 N., R. 3 W.:

A11—0 to 5 inches, yellowish-brown (10YR 5/4) sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores and few very fine tubular pores; medium acid; clear, smooth boundary.

A12—5 to 17 inches, yellowish-brown (10YR 5/4) sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial and tubular pores; very few thin clay films in pores; slightly acid; abrupt, wavy boundary.

R—17 inches, sandstone; continuous moderately thick clay films on surfaces of fracture planes.

The A horizon ranges from 8 to 18 inches in thickness, from dark grayish brown to yellowish brown in color, from sandy loam to light loam in texture, and from slightly acid to medium acid in reaction. Hard sandstone or conglomerate bedrock is at a depth of 8 to 18 inches.

Gaviota soils generally are near areas of Lodo, Millsap, Millsholm, and Sehorn soils.

Gaviota fine sandy loam, 3 to 15 percent slopes (GaC).—This soil has a profile similar to the one described as representative for the series, except that the texture of the surface layer is fine sandy loam to light loam. It is well drained and has moderately rapid permeability.

Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 1.5 to 3 inches. Hard sandstone is at a depth of 10 to 18 inches.

Included with this soil in mapping were some areas of soils as deep as 26 inches over sandstone. Also included were areas of a moderately deep to deep, reddish-brown soil that has a fine sandy loam surface layer and a loam subsoil. A soil that has a gravelly loam surface layer and a clay loam subsoil was also included.

This Gaviota soil is used as irrigated and dryland pasture and range. Capability unit VIe–1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Gaviota fine sandy loam, 15 to 30 percent slopes (GaD).—This soil has a profile similar to the one described as representative for the series, except that the texture of the surface layer is fine sandy loam to light loam. The soil is well drained and has moderately rapid permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 1.5 to 3 inches. Hard sandstone bedrock is at a depth of 10 to 18 inches.

Included with this soil in mapping were areas of a soil that is about 18 to 26 inches deep to hard sandstone. Also included were areas of Lodo, Millsap, and Millsholm soils.

This Gaviota soil is used mainly as range and wildlife habitat and for watershed. Capability unit VIe–1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Gaviota very rocky sandy loam, 0 to 30 percent slopes (GbD).—This soil has the profile described as representative for the series. It is well drained and has moderately rapid permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 1 to 2.5 inches. Hard sandstone bedrock is at a depth of 10 to 18 inches. Rock outcrops cover 10 to 25 percent of the surface.

Included with this soil in mapping were areas of a soil that is more than 18 inches deep to hard sandstone bedrock. Also included were areas of Lodo, Millsap, and Millsholm soils.

This Gaviota soil is used as range and wildlife habitat and for watershed. Capability unit VIs–1(15, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Gaviota very rocky sandy loam, 30 to 50 percent slopes, eroded (GbE2).—This soil is somewhat excessively drained and has moderately rapid permeability. Runoff is rapid, and the hazard of further erosion is high. Available water capacity is 1 to 2 inches. Hard standstone bedrock is at a depth of 8 to 15 inches. Exposed bedrock outcrops cover 10 to 25 percent of the surface.

Included with this soil in mapping were areas of Lodo, Millsholm, and Millsap soils.

This Gaviota soil is used as range and wildlife habitat and for watershed. Capability unit VIIs–1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 6.

Goulding Series

The Goulding series consists of well-drained soils that are underlain by greenstone. These soils are on uplands near Platina, Whiskeytown, Keswick, Central Valley, and Ingot. Slopes range from 10 to 70 percent. Elevation ranges from 700 to 1,500 feet. The annual precipitation is 40 to 50 inches, and the average annual air temperature is about 55° F. The 32° F. growing season is 150 to 250 days, and the 28° F. growing season is 250 to 350 days. The vegetation is shrubs or grass-oak.

In a representative profile the surface layer is brown, slightly acid very stony loam about 5 inches thick. The subsoil and substratum are pale-brown, medium acid gravelly loam. Fractured greenstone is at a depth of 16 inches.

The areas of Goulding soils are used as range and wildlife habitat and for watershed.

Representative profile of Goulding very stony loam, 10 to 30 percent slopes, about 2½ miles southwest of Oak Run, along Oak Run Road, 800 feet east-southeast of the northwest corner of sec. 2, T. 32 N., R. 2 W.

A1—0 to 5 inches, brown (10YR 5/3) very stony loam, dark brown (10YR 3/3) moist; moderate, medium, granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; slightly acid; clear, smooth boundary.

B2—5 to 12 inches, pale-brown (10YR 6/3) gravelly loam, dark brown (10YR 3/3) moist; weak, medium, granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, and coarse roots; many very fine tubular and interstitial pores; worm casts; medium acid; clear, smooth boundary.

C—12 to 16 inches, pale-brown (10YR 6/3) gravelly loam, dark brown (7.5YR 4/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots and common very fine and coarse roots; many very fine tubular and interstitial pores; worm casts; medium acid; gradual, wavy boundary.

R—16 inches, fractured greenstone; moderately thick clay films along cracks.

The A horizon ranges from 5 to 12 inches in thickness and from brown to yellowish brown in color. It is gravelly loam in texture and slightly acid to medium acid in reaction. The B2 horizon is 7 to 15 inches thick, is pale brown, brown or yellowish brown in color, and is slightly acid to medium acid in reaction. The C horizon is 0 to 16 inches thick. Fractured metavolcanic rock is at a depth of 12 to 24 inches. The soil is very stony on the surface and contains fewer coarse fragments throughout the profile than the Goulding soils recognized elsewhere in California.

Goulding soils generally are near areas of Auburn, Boomer, Diamond Springs, Neuns, and Stonyford soils.

Goulding very stony loam, 10 to 30 percent slopes (GdD).—This soil has the profile described as representative for the series. Permeability is moderate. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 2 to 4 inches. Fractured greenstone is at a depth of 12 to 24 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were areas of Auburn and Diamond Springs soils.

This Goulding soil is used mainly as range. Capability unit VIs–1(15, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Goulding very rocky loam, 30 to 50 percent slopes, eroded (GeE2).—This soil has been exposed to smelter fumes or fire in many places; and the native vegetation has been destroyed and replaced by manzanita, scrub oak, yerba santa, and ceanothus. The surface layer is strongly acid in these areas. Permeability is moderate. Runoff is

rapid, and the hazard of further erosion is high. Available water capacity is 2 to 4 inches. Fractured greenstone is at a depth of 12 to 24 inches. Exposed bedrock outcrops cover 2 to 25 percent of the surface.

Included with this soil in mapping were areas of Auburn and Diamond Springs soils.

This soil is used as range and wildlife habitat and for watershed. Capability unit VIIs–1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Goulding very rocky loam, 50 to 70 percent slopes, eroded (GeF2).—This soil has moderate permeability. Surface runoff is very rapid, and the hazard of further erosion is very high. Available water capacity is 2 to 4 inches. Fractured greenstone is at a depth of 12 to 24 inches. Exposed bedrock outcrops cover 2 to 25 percent of the surface.

Included with this soil in mapping were small areas of Auburn and Diamond Springs soils.

This Goulding soil is used as range and wildlife habitat and for watershed. Capability unit VIIs–1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 6.

Gravel Pits

Gravel pits (Gp) consists of excavations, 5 to 40 feet deep, from which sand and gravel have been removed. These pits are on flood plains of the major streams in the central part of the survey area that extends from Cottonwood to Redding and Bella Vista. Elevation ranges from 350 to 500 feet. Gravel pits are near areas of Anderson and Reiff soils; Cobbly alluvial land; Cobbly alluvial land, frequently flooded; and Tailings and Placer diggings.

The materials in the pits are sand, gravel, and cobblestones. Recent pits have no vegetation, but older pits have sparse stands of grasses and willows. A few pits contain water throughout the year. This land type is excessively drained. Permeability is rapid. Runoff is very slow, and the hazard of erosion, or flood scour, is severe.

The areas of Gravel pits are used as sites for urban and industrial developments. They have no value for farming. Capability unit VIIIw–1(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Guenoc Series

The Guenoc series consists of well-drained soils that are underlain by volcanic rocks. These soils are on lava flows in the foothills east of the Sacramento River between Millville, Black Butte, and Oak Run. Slopes range from 0 to 50 percent. Elevation ranges from 800 to 1,500 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 60° F. The 32° F. growing season is 200 to 225 days, and the 28° F. growing season is 250 to 300 days. The vegetation consists of annual grasses, blue oak, interior live oak, manzanita, and Digger pine.

In a representative profile the surface layer is reddish-brown, slightly acid very stony loam about 5 inches thick. The subsoil is dark-red, slightly acid cobbly clay loam and dark-red, medium acid very cobbly heavy clay loam. Andesite bedrock is at a depth of about 23 inches.

The areas of Guenoc soils are used as range and wildlife habitat and for watershed.

Representative profile of Guenoc very rocky loam, 0 to 30 percent slopes, approximately 2¾ miles east-southeast of Millville at the southeast corner of sec. 18, T. 31 N., R. 2 W.:

A1—0 to 5 inches, reddish-brown (5YR 4/4) very stony loam, dark reddish brown (2.5YR 3/3) moist; weak, very fine, granular structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular and interstitial pores and common fine tubular pores; many concretions, ½ to 1 millimeter in diameter; slightly acid; clear, smooth boundary.

B1t—5 to 12 inches, dark-red (2.5YR 3/6) cobbly light clay loam, dark reddish brown (2.5YR 2/4) moist; weak, very fine, granular structure; slightly hard, friable, sticky and plastic; few fine roots and common medium roots; many very fine tubular and interstitial pores and common fine and medium tubular pores; few thin clay films in pores; slightly acid; gradual, smooth boundary.

B2t—12 to 23 inches, dark-red (2.5YR 5/6) very cobbly heavy clay loam, dark reddish brown (2.5YR 2/4) moist; moderate, fine, granular structure; hard, friable, sticky and plastic; few fine roots and many medium roots; many very fine tubular and interstitial pores and common fine and medium tubular pores; few thin clay films in pores; many very fine concretions; medium acid; clear, irregular boundary.

R—23 inches, andesitic bedrock that is coated with a thin layer of dark reddish-brown (2.5YR 3/3) heavy clay loam that fills cracks and pockets between stones and cobblestones; many, medium, horizontal roots just above bedrock.

The A horizon ranges from 5 to 12 inches in thickness and from slightly acid to medium acid in reaction. The B2t horizon ranges from 8 to 24 inches in thickness, from dark red or dark reddish brown to yellowish red in color, from cobbly heavy clay loam to very cobbly clay in texture, and from slightly acid to medium acid in reaction. Hard andesite or, less commonly, hard basalt bedrock is at a depth ranging from 20 to 40 inches. This soil has more cobblestones in the B2t horizon than the Guenoc soils recognized elsewhere in California.

Guenoc soils generally are near areas of Aiken, Cohasset, Inks, Supan, Toomes, and Tuscan soils.

Guenoc very stony loam, 0 to 30 percent slopes (GsD).—This soil has moderately slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 4 to 6 inches. Andesite bedrock is at a depth of about 30 to 40 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Aiken and Supan soils and small areas of soils that have only a few stones on the surface.

This Guenoc soil is used mainly as range. The small included areas that have only a few stones on the surface are used for dryland hay and grain. Capability unit VIs–1 (15, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Guenoc very rocky loam, 0 to 30 percent slopes (GuD).—This soil has the profile described as representative for the series. Permeability is moderately slow. Runoff is slow to rapid, and the hazard of erosion is slight to high. Available water capacity is 3 to 4.5 inches, Andesite bedrock is at a depth of 20 to 30 inches. Exposed bedrock outcrops cover 10 to 25 percent of the surface.

Included with this soil in mapping were small areas of Aiken, Supan, and Toomes soils.

This Guenoc soil is used as range. Capability unit VIs-1(15, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Guenoc very rocky loam, 30 to 50 percent slopes (GuE).—This soil has moderately slow permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 3 to 5.5 inches. Andesite bedrock is at a depth of 20 to 36 inches. Exposed bedrock outcrops cover 10 to 25 percent of the surface.

Included with this soil in mapping were small areas of Aiken, Supan, and Toomes soils.

This Guenoc soil is used as range and wildlife habitat and for watershed. Capability unit VIIs-1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Henneke Series

The Henneke series consists of well-drained soils that are underlain by ultrabasic rocks. These soils are on uplands west of Ono. Slopes range from 15 to 60 percent. Elevation ranges from 1,000 to 2,500 feet. The annual precipitation is 35 to 45 inches, and the average annual air temperature is about 60° F. The 32° F. growing season is 150 to 200 days, and the 28° F. growing season is 250 to 300 days. The vegetation is a sparse cover of annual grasses and forbs, shrubs, and Digger pine.

In a representative profile the surface layer is reddish-gray, neutral heavy loam about 10 inches thick. The subsoil is reddish-brown, neutral very stony heavy clay loam. Weathered serpentine rock is at a depth of 16 inches.

The areas of Henneke soils are used as range and wildlife habitat and for watershed.

Representative profile of Henneke very rocky loam, 15 to 60 percent slopes, about 4 miles west of Ono and 400 feet west of the southwest corner of sec. 5, T. 30 N., R. 7 W.:

A1—0 to 10 inches, reddish-gray (5YR 5/2) heavy loam, dark reddish brown (2.5YR 3/3) moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; many very fine roots; many very fine and fine interstitial pores; neutral; clear, smooth boundary.

B2t—10 to 16 inches, reddish-brown (5YR 4/3) very stony heavy clay loam, dark reddish brown (2.5YR 3/4) moist; weak, fine, subangular blocky structure; slightly hard, friable, nonsticky and slightly plastic; common very fine roots; common very fine and few fine interstitial pores; many thin clay films in pores; neutral; clear, smooth boundary.

C—16 inches, light-gray, light olive-brown, and very dark gray weathered serpentine.

The A horizon ranges from 6 to 10 inches in thickness, from brown to reddish gray in color, and from medium acid to neutral in reaction. The B2t horizon ranges from 6 to 14 inches in thickness, from reddish yellow or reddish brown to red in color, from stony heavy clay loam to very stony clay in texture, and from slightly acid to neutral in reaction. Weathered serpentine or, less commonly, peridotite rock is at a depth of 12 to 24 inches.

Henneke soils generally are near areas of Auburn, Boomer, Goulding, Josephine, and Stonyford soils.

Henneke very rocky loam, 15 to 60 percent slopes (HeF).—This is the only Henneke soil mapped in this survey area. It has moderately slow permeability. Runoff is rapid to very rapid, and the hazard of erosion is high to very high. Available water capacity is 1 to 3 inches. Serpentine bedrock is at a depth of 12 to 24 inches. Exposed bedrock outcrops cover 10 to 25 percent of the surface.

Included with this soil in mapping were small areas of a shallow to moderately deep reddish-brown soil that has a loam surface layer and a clay loam subsoil. This inclusion formed in material weathered from serpentine. Also included were some areas of Landslides.

This Henneke soil is used as range and wildlife habitat and for watershed. Capability unit VIIs-1(15, 17, 18); Very Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Hillgate Series

The Hillgate series consists of well-drained loams that formed in mixed alluvium on low terraces. They are along the lower part of Cow Creek near Palo Cedro and in areas of Bald Hills south of Ono. Slopes range from 0 to 2 percent. Elevation ranges from 600 to 900 feet. The annual precipitation is 20 to 30 inches, and the average annual air temperature is about 60° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 300 to 350 days. The vegetation is grasses or grass-oak.

In a representative profile the surface layer is pale-brown, medium acid loam about 8 inches thick. The subsoil, to a depth of about 50 inches, is pale-brown, slightly acid and mildly alkaline clay; and, to a depth of about 65 inches, it is light yellowish-brown and yellowish-brown, mildly alkaline clay. The substratum is pale-brown, mildly alkaline clay loam.

The areas of these soils are used mainly for field crops.

Representative profile of Hillgate loam, 3⅓ miles northeast of Anderson and ¼ mile southeast of northwest corner of sec. 8, T. 30 N., R. 3 W.:

Ap—0 to 5 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; strong, fine, subangular blocky structure; hard, friable, nonsticky and slightly plastic; common very fine roots; many very fine tubular pores; medium acid; abrupt, wavy boundary.

A1—5 to 8 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, friable, nonsticky and slightly plastic; common very fine roots; many very fine tubular pores; lower ½ to 1 inch has common, fine, faint, light brownish-gray mottles and few, fine, prominent, yellowish-red mottles; medium acid; abrupt, smooth boundary.

B21t—8 to 31 inches, pale-brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; weak, coarse, prismatic structure; extremely hard, very firm, very sticky and very plastic; common very fine exped roots; many very fine tubular pores; common moderately thick clay films on ped faces; coatings of material from the A horizon extend 1 to 2 inches into top of this horizon, mostly along ped faces; slightly acid; clear, smooth boundary.

B22t—31 to 50 inches, pale-brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; weak, coarse, prismatic structure; extremely hard, very firm, very sticky and very plastic; very few fine exped roots; common very fine tubular pores; common moderately thick clay films on ped faces; shrinkage cracks extend into this horizon when soil is dry; mildly alkaline; clear, smooth boundary.

B3t—50 to 65 inches, light yellowish brown and yellowish-brown (10YR 6/4 and 5/4) clay, dark yellowish brown (10YR 4/4) moist; common, fine, faint, dark yellowish-brown mottles; massive; extremely hard, firm, sticky and very plastic; very few fine roots; few very fine tubular pores; many moderately thick clay films in pores; mildly alkaline, clear, smooth boundary.

C—65 to 80 inches, pale-brown (10YR 6/3) heavy clay loam, dark brown (10YR 4/3) moist; massive; very hard, firm, slightly sticky and plastic; very few fine roots; few very fine tubular pores; few moderately thick clay films and common thin clay films as bridges; mildly alkaline.

The A horizon ranges from 8 to 24 inches in thickness, from pale brown to light gray in color, from fine sandy loam to loam in texture, and from slightly acid to medium acid in reaction. The B2t horizon ranges from 22 to 50 inches in thickness, from brown or pale brown to light gray in color, and from heavy clay loam to clay in texture. The C horizon ranges from dark yellowish brown to very pale brown in color, from loam to clay in texture, and from slightly acid to moderately alkaline in reaction.

Hillgate soils generally are near areas of Churn, Inks, Los Robles, Newtown, Supan, and Tehama soils.

Hillgate loam (Hb).—This is the only Hillgate soil mapped in the survey area. It has very slow permeability. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 2 to 4 inches, as only small amounts of water are available from the clay subsoil. The effective depth to which roots can penetrate is restricted by the clay subsoil that is at a depth of 8 to 24 inches. Very few roots penetrate the lower part of the subsoil.

Included with this soil in mapping were areas of a very deep pale-brown soil that has a gradual transition in texture from the surface layer to the subsoil. Also included were areas of Tehama soils.

This Hillgate soil is used for irrigated hay and pasture and for dryland pasture. Capability unit IVs–3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Holland Series

The Holland series consists of well-drained soils that are underlain by granitic rock. These soils are on uplands in the western part of the survey area between Ono and French Gulch. Slopes range from 15 to 70 percent. Elevation ranges from 1,500 to 3,500 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 56° F. The 32° F. growing season is 150 to 200 days, and the 28° F. growing season is 250 to 300 days. The vegetation is mixed conifers, oaks, shrubs, and grasses.

In a representative profile the surface layer is grayish-brown and pale-brown, medium acid sandy loam and pale-brown, strongly acid loam about 6 inches thick. The upper part of the subsoil is reddish-yellow and yellowish-red, strongly acid clay loam about 28 inches thick. The lower part of the subsoil, to a depth of more than 60 inches, is reddish-yellow, very strongly acid loam.

The areas of Holland soils are used as range, woodland, and wildlife habitat and for watershed.

Representative profile of Holland sandy loam, 15 to 50 percent slopes, at the Crystal Creek Conservation Camp, about 600 feet southwest of NE¼ sec. 17, T. 32 N., R. 7 W.:

A11—0 to 1 inch, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many fine and medium interstitial pores; medium acid; abrupt, smooth boundary.

A12 1 to 2 inches, pale-brown (10YR 6/3) sandy loam, dark grayish brown (10YR 4/2) moist; moderate, medium, granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; medium acid; clear, smooth boundary.

A3—2 to 6 inches, pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; strongly acid; gradual, smooth boundary.

B21t—6 to 20 inches, reddish-yellow (5YR 6/6) clay loam, reddish brown (5YR 4/4) moist; strong, medium, subangular blocky structure; hard, firm, slightly sticky and plastic; very few fine, medium, and coarse roots; few very fine and fine interstitial and tubular pores; few thin clay films in pores; strongly acid; diffuse, smooth boundary.

B22t—20 to 34 inches, yellowish-red (5YR 5/6) clay loam, strong brown (7.5YR 5/6) moist; strong, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; very few fine, medium, and coarse roots; few very fine and fine tubular pores; few thin clay bridges; strongly acid; diffuse, smooth boundary.

B3—34 to 60 inches, reddish-yellow (7.5YR 6/6) dry or moist heavy loam; moderate, coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine and fine tubular pores; very few moderately thick clay films in pores and on ped faces; very strongly acid.

The A horizon ranges from 5 to 10 inches in thickness, from grayish brown to very pale brown in color, and from slightly acid to strongly acid in reaction. The B2t horizon ranges from 25 to 40 inches in thickness, from yellowish red to reddish yellow in color, and from medium acid to very strongly acid in reaction. The B3 horizon is 10 to 30 inches thick. The C horizon, if present, is reddish-yellow heavy loam. It is very strongly acid. Strongly weathered quartz diorite rock is at a depth of 40 to more than 60 inches.

Holland soils generally are near areas of Chaix, Corbett, Kanaka, and Sierra soils.

Holland sandy loam, 15 to 50 percent slopes (HcE).—This soil has the profile described as representative for the series. Permeability is moderately slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 7 to 11 inches. Weathered quartz diorite is at a depth of 40 to more than 60 inches.

Included with this soil in mapping were small areas of a similar soil that has a slowly permeable clay subsoil. Also included were areas of Auburn and Chaix soils and areas of eroded soils.

This Holland soil is used as woodland and wildlife habitat and for watershed. Capability unit VIe–1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Holland sandy loam, 50 to 70 percent slopes (HcF).—This soil has moderately slow permeability. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 7 to 11 inches. Weathered quartz diorite is at a depth of 40 to more than 60 inches.

Included with this soil in mapping were small areas of a similar soil that has a slowly permeable clay subsoil. Also included were some areas of eroded soils and some areas of Auberry and Chaix soils.

This Holland soil is used as woodland and wildlife habitat and for watershed. Capability unit VIIe–1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Honcut Series

The Honcut series consists of well-drained soils that formed mainly in basic alluvium. These soils are on alluvial plains of small streams in the central part of the

survey area from Redding and Olinda east to Palo Cedro and Bella Vista. Slopes are 0 to 2 percent. Elevation ranges from 500 to 800 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 250 to 325 days. The vegetation is blue oak, interior live oak, manzanita, poison oak, annual grasses, and Digger pine.

In a representative profile the surface layer is brown, slightly acid loam about 22 inches thick. The substratum, to a depth of 60 inches or more, is mixed strong-brown and brown or pale-brown, slightly acid light loam.

The areas of Honcut soils are used for irrigated crops and as dryland pasture.

Representative profile of Honcut loam, 360 feet south of the abandoned State Route 44 bridge across Stillwater Creek, about 5 miles east of Redding and 600 feet southwest of the N¼ corner of sec. 1, T. 31 N., R. 4 W.:

A1—0 to 22 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many fine, medium, and coarse tubular pores and many very fine interstitial pores; many krotovinas; slightly acid; diffuse, smooth boundary.

C1—22 to 37 inches, mixed strong-brown (7.5YR 5/6) and brown (10YR 5/3) light loam, dark brown (7.5YR 3/4) moist; massive; hard, very friable, slightly sticky and slightly plastic; common very fine roots; many fine, medium, and coarse tubular pores; slightly acid; diffuse, smooth boundary.

C2—37 to 60 inches, mixed strong-brown (7.5YR 5/6) and pale-brown (10YR 6/3) light loam, dark brown (7.5YR 3/4) moist; massive; hard, very friable, slightly sticky and slightly plastic; few very fine roots; many fine and medium tubular pores; stratified; contains few thin lenses of coarser soil material; slightly acid.

The A horizon ranges from 12 to 24 inches in thickness, from brown to strong brown in color, from loam to gravelly loam in texture, and from slightly acid to medium acid in reaction. The C horizon ranges from pale brown to reddish brown in color, from loam to very gravelly loam in texture, and from slightly acid to medium acid in reaction. At a depth of more than 60 inches, this soil is underlain by stratified alluvium from basic igneous rocks.

Honcut soils generally are near areas of Anderson, Churn, Perkins, and Vina soils.

Honcut loam (Hd).—This soil has the profile described as representative for the series. Permeability is moderate. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 9 to 11 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Anderson and Churn soils.

This Honcut soil is used for irrigated hay and as irrigated and dryland pasture. Capability unit I–1(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Honcut gravelly loam (He).—This soil has a profile similar to the one described as representative for the series, except that the surface layer is gravelly loam about 20 inches thick. Permeability is moderate. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 7 to 9 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Anderson and Churn soils. Also included were small areas of a Honcut soil that has a surface layer of gravelly sandy loam.

This Honcut soil is used as irrigated pasture and for irrigated and dryland hay. Small areas are used for irrigated crops and orchards. Capability unit IIs–4(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Honcut gravelly loam, deep (Hf).—This soil has a profile similar to the one described as representative for the series, except that it has a surface layer of gravelly loam, and, below a depth of about 40 inches, it has a substratum of very gravelly loam. Permeability is moderate above the very gravelly loam substratum, and rapid in the substratum. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 6 to 8 inches.

Included with this soil in mapping were small areas of a soil that is less than 40 inches deep to the very gravelly substratum. Also included were areas of Anderson and Churn soils.

Most of this Honcut soil is used for irrigated hay and as irrigated and dryland pasture. Small areas are used for irrigated crops and orchards. Capability unit IIs–0(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Honn Series

The Honn series consists of well-drained soils that formed mainly in basic tuffaceous alluvium. These soils are on low terraces in the east-central part of the survey area along lower Cow Creek and its tributaries. Slopes are 0 to 8 percent. Elevation ranges from 400 to 600 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 225 to 250 days, and the 28° F. growing season is 275 to 325 days. The vegetation is valley oak, blue oak, interior live oak, Digger pine, manzanita, and annual grasses and forbs.

In a representative profile the surface layer is grayish-brown, medium acid gravelly sandy loam, about 8 inches thick, and brown, medium acid gravelly heavy sandy loam about 9 inches thick. The subsoil is medium acid gravelly sandy clay loam about 29 inches thick. It is brown and pale brown in the upper part and light brownish gray and dark yellowish brown in the lower part. The substratum, to a depth of more than 60 inches, is light-gray, slightly acid, very gravelly sandy clay loam.

The areas of Honn soils are used for field crops or as dryland pasture.

Representative profile of Honn gravelly sandy loam, 0 to 3 percent slopes, about 1 mile west of Millville and ¼ mile east-southeast of NW¼ corner of sec. 15, T. 31 N., R. 3 W.:

A11—0 to 3 inches, grayish-brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak, thin and medium, platy structure parting to moderate, medium, granular structure, slightly hard, friable, nonsticky and nonplastic; many very fine roots; many fine interstitial pores; medium acid; abrupt, smooth boundary.

A12—3 to 8 inches, grayish-brown (10YR 5/2) gravelly sandy loam, dark brown (10YR 3/3) moist; massive; hard, friable, nonsticky and nonplastic; common fine roots; many very fine tubular and interstitial pores and very few medium tubular pores; medium acid; clear, smooth boundary.

A3—8 to 17 inches, brown (10YR 5/3) gravelly heavy sandy loam, very dark grayish brown (10YR 3/2) moist;

massive; very hard, friable, nonsticky and nonplastic; very few fine and coarse roots; many very fine tubular and interstitial pores and very few medium tubular pores; medium acid; clear, smooth boundary.

B1—17 to 24 inches, brown (10YR 5/3) gravelly light sandy clay loam, dark brown (10YR 3/3) moist; massive; very hard, friable, nonsticky and slightly plastic; very few fine and medium roots; many very fine tubular and interstitial pores and very few medium tubular pores; few thin clay films in pores; medium acid; clear, smooth boundary.

B2t—24 to 32 inches, brown and pale-brown (10YR 5/3 and 6/3) gravelly sandy clay loam, dark brown (7.5YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; very few fine and medium roots; many very fine tubular pores; common moderately thick clay films in pores and few thin clay films as bridges; medium acid; clear, smooth boundary.

B3t—32 to 46 inches, light brownish-gray and dark yellowish-brown (10YR 6/2 and 4/4) gravelly heavy sandy clay loam, dark yellowish brown (10YR 3/4) moist; few, fine, distinct, dark reddish-brown mottles and common, fine, faint, very dark grayish-brown mottles moist; massive; very hard, friable, slightly sticky and slightly plastic; very few fine and medium roots; many very fine interstitial pores and few very fine tubular pores; few moderately thick clay films in pores and common moderately thick clay films as bridges; medium acid; clear, smooth boundary.

IIC—46 to 60 inches, light-gray (10YR 7/2) very gravelly sandy clay loam, dark yellowish brown (10YR 3/4) moist; common, fine, distinct, dark reddish-brown and black mottles moist; massive; hard, friable, slightly sticky and slightly plastic; very few fine and medium roots; many very fine interstitial pores; pockets of highly mottled material; slightly acid.

The A horizon ranges from 15 to 30 inches in thickness, from gravelly sandy loam to fine sandy loam in texture, and from medium acid to slightly acid in reaction. The B2t horizon ranges from 8 to 20 inches in thickness, from brown to very pale brown in color, and from gravelly sandy clay loam to gravelly clay loam in texture. The IIC horizon is very gravelly light sandy clay loam to very gravelly clay loam.

Honn soils generally are near areas of Anderson, Churn, Hillgate, Keefers, Los Robles, Molinos, and Vina soils and of Cobbly alluvial land, frequently flooded.

Honn fine sandy loam, 0 to 3 percent slopes (HgA).—This soil has a profile similar to that described as representative for the series, except that it has a surface layer of fine sandy loam about 20 inches thick. Permeability is moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 7.5 to 9 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of a soil that has a strongly cemented substratum at a depth of 36 to 60 inches. Also included were areas of Anderson and Hillgate soils.

This Honn soil is used for irrigated hay and as irrigated and dryland pasture. Small areas are used for irrigated crops and orchards. Capability unit I–1(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Honn fine sandy loam, 3 to 8 percent slopes (HgB).—This soil has a profile similar to that described as representative for the series, except that it has a surface layer of fine sandy loam about 20 inches thick. Permeability is moderately slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 6 to 9 inches. Roots of most plants can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of a soil that has a strongly cemented substratum at a depth of less than 42 inches. Also included were areas of Hillgate and Molinos soils.

This Honn soil is used mainly for irrigated hay and as irrigated and dryland pasture. Small areas are used for irrigated crops and orchards. Capability unit IIe–1(17, 18); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Honn gravelly sandy loam, 0 to 3 percent slopes (HhA).—This soil has the profile described as representative for the series. Permeability is moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 5 to 8 inches. Roots of most plants can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of a soil that has a strongly cemented layer at a depth of less than 42 inches. Also included were areas of Anderson, Hillgate, and Molinos soils and of Cobbly alluvial land, frequently flooded.

This Honn soil is used mainly for irrigated hay and as irrigated and dryland pasture. Small areas are used for irrigated crops and orchards. Capability unit IIs–4(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Igo Series

The Igo series consists of well-drained soils that have an indurated hardpan. These soils formed mainly in old alluvium from basic rock sources. They are on hummocky high terraces of Swede Creek Plains, Millville Plains, and northwest of Coleman Reservoir in the central part of the survey area. Slopes are 0 to 8 percent. Elevation ranges from 600 to 800 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 225 to 275 days, and the 28° F. growing season is 275 to 325 days. The vegetation is annual grasses and forbs.

In a representative profile the surface layer is yellowish-red, strongly acid gravelly loam about 3 inches thick. The subsoil is yellowish-red, slightly acid gravelly heavy loam about 4 inches thick. Below this layer is an indurated gravelly hardpan about 15 inches thick. Below the hardpan, to a depth of more than 60 inches, is a substratum of stratified mixed alluvium of sand to clay in texture.

The areas of Igo soils are used as range.

Representative profile of Igo gravelly loam, 0 to 8 percent slopes, on Millville Plains 700 feet east of the southwest corner of sec. 23, T. 31 N., R. 3 W.:

Ap—0 to 3 inches, yellowish-red (5YR 5/6) gravelly loam, dark reddish brown (5YR 3/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores and many very fine interstitial pores; strongly acid; clear, smooth boundary.

B2t—3 to 7 inches, yellowish-red (5YR 5/6) gravelly heavy loam, dark reddish brown (5YR 3/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial pores and common very fine tubular pores; nearly continuous clay films in most pores; slightly acid; abrupt, wavy boundary.

C1m—7 to 22 inches, indurated gravelly hardpan; intermittent thin pockets of clay in depressions; diffuse, irregular boundary.

IIC2—22 to 60 inches, stratified mixed alluvium of sand to clay in texture.

The A horizon ranges from 1 to 9 inches in thickness, from strong brown to yellowish red in color, from gravelly loam to very fine sandy loam in texture, and from medium acid to strongly acid in reaction. The B2t horizon ranges from 2 to 5 inches in thickness, from reddish brown to yellowish red in color, from gravelly heavy loam to gravelly clay loam in texture, and from slightly acid to strongly acid in reaction. The hardpan is at a depth of 3 to 12 inches. The IIC2 horizon is very cobbly in some places.

Igo soils generally are near areas of Inks, Keefers, Supan, Toomes, and Tuscan soils.

Igo gravelly loam, 0 to 8 percent slopes (IaB).—This is the only Igo soil mapped in the survey area. It has very slow permeability in the hardpan. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 0.3 to 1.5 inches. The hardpan is at a depth of 3 to 12 inches.

Included with this soil in mapping were small areas of a soil in which the hardpan is exposed on the surface and areas of a soil that has a thin discontinuous clay layer over the hardpan. Also included were areas of Keefers and Tuscan soils.

This Igo soil is used as range. Capability unit VIIs–1 (15, 17, 18); Very Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 3.

Inks Series

The Inks series consists of well-drained and somewhat excessively drained soils that are underlain by cemented, tuffaceous sediment. These soils are on uplands in the east-central part of the survey area from Battle Creek to Millville and Oak Run. Slopes range from 3 to 50 percent. Elevation ranges from 500 to 900 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 175 to 225 days, and the 28° F. growing season is 250 to 300 days. The vegetation is grass-oak and scattered Digger pine, manzanita, and ceanothus.

In a representative profile the surface layer is brown, neutral and slightly acid gravelly loam and loam about 14 inches thick. The subsoil is brown, slightly acid very gravelly clay loam. Weathered tuff is at a depth of about 19 inches.

The areas of Inks soils are used as range, dryland pasture, and wildlife habitat and for watershed.

Representative profile of Inks gravelly loam, 8 to 30 percent slopes, approximately 4½ miles northeast of Anderson, 700 feet southeast of N¼ corner of sec. 8, T. 30 N., R. 3 W.:

A11—0 to 7 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores and few very fine tubular pores; neutral; gradual, smooth boundary.

A12—7 to 14 inches, brown (10YR 5/3) loam, dark yellowish brown (10YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine and fine tubular pores; slightly acid; clear, smooth boundary.

B2t—14 to 19 inches, brown (10YR 5/3) very gravelly clay loam, dark yellowish brown (10YR 3/4) moist; massive; hard, firm, sticky and plastic; common fine and medium roots; few very fine and fine tubular pores; slightly acid; abrupt, smooth boundary.

R—19 inches, white (2.5Y 8/2), strongly consolidated, weathered tuff; continuous black stains, few thick reddish-yellow clay films, and many fine to coarse roots in fractures.

The A horizon ranges from 7 to 14 inches in thickness, from brown to dark brown in color, and from loam to gravelly loam or very stony loam in texture. The B2t horizon ranges from 3 to 7 inches in thickness, from brown to light brown in color, from gravelly heavy loam to very gravelly clay loam in texture, and from medium acid to neutral in reaction. Cemented tuffaceous sediment is at a depth of 10 to 20 inches. Most areas of this soil are gravelly to very gravelly throughout. Some areas are cobbly throughout.

Inks soils generally are near areas of Guenoc, Keefers, Pentz, Supan, Toomes, and Tuscan soils.

Inks gravelly loam, 8 to 30 percent slopes (IbD).—This soil has the profile described as representative for the series. It is well drained. Permeability is moderate. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 1 to 2 inches. Tuff is at a depth of 10 to 20 inches.

Included with this soil in mapping were small areas of Pentz, Supan, and Tuscan soils. Also included were areas of a soil that has a surface layer of cobbly loam.

This Inks soil is used as range and wildlife habitat and for watershed. Small areas are used as irrigated pasture. Capability unit VIe–1 (15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Inks very stony loam, 3 to 30 percent slopes (IdD).—This soil is well drained. Permeability is moderate. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 1 to 2 inches. Tuff is at a depth of 10 to 20 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Pentz, Supan, and Tuscan soils.

This Inks soil is used mainly as range, dryland pasture, and wildlife habitat. Small areas are used as irrigated pasture. Capability unit VIs–1 (15, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Inks very stony loam, 30 to 50 percent slopes (IdE).—This soil is somewhat excessively drained. Permeability is moderate. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 1 to 2 inches. Tuff is at a depth of 10 to 20 inches. Stones cover about 3 to 15 percent of the surface.

Included with this soil in mapping were areas of Pentz, Supan, and Tuscan soils.

This Inks soil is used as range and wildlife habitat and for watershed. Capability unit VIIs–1 (15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Inks-Pentz complex, 5 to 30 percent slopes (IeD).—About 50 percent of this complex is Inks gravelly loam, 8 to 30 percent slopes, and about 35 percent is Pentz very stony sandy loam, 5 to 30 percent slopes. The remaining 15 percent consists of inclusions of a moderately deep soil that formed in mixed alluvium and of a moderately deep soil underlain by taffaceous bedrock. The Inks and the Pentz soil each has a profile similar to that described as representative for its respective series.

The Inks soil is well drained and has moderate permeability. Available water capacity is 1 to 2 inches. Tuff is at a depth of 10 to 20 inches.

The Pentz soil is well drained and has moderately rapid

permeability. Available water capacity is 1 to 2.5 inches. Tuff is at a depth of 6 to 20 inches. Stones cover about 3 to 15 percent of the surface.

Runoff is medium to rapid on the soils of this unit. The hazard of erosion is moderate to high.

The areas of these soils are used as range and wildlife habitat and for watershed. Capability unit VIs–1(15, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Inks-Pentz complex, 30 to 50 percent slopes (IeE).—About 50 percent of this complex is Inks very stony loam, 30 to 50 percent slopes, and about 35 percent is Pentz very stony sandy loam. The remaining 15 percent consists of inclusions of an unnamed moderately deep soil that formed in gravelly mixed alluvium and of areas of a deep to moderately deep soil underlain by tuffaceous bedrock. The Inks and the Pentz soil each has a profile similar to that described as representative for its respective series.

The Inks soil has moderate permeability. Available water capacity is 1 to 2 inches. Tuff is at a depth of 10 to 20 inches. Stones cover 3 to 15 percent of the surface.

The Pentz soil has moderately rapid permeability. Available water capacity is 1 to 2.5 inches. Tuff is at a depth of 6 to 20 inches. Stones cover 3 to 15 percent of the surface.

The soils of this unit are somewhat excessively drained. Runoff is rapid, and the hazard of erosion is high.

The areas of these soils are used as range and wildlife habitat and for watershed. Capability unit VIIs–1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Jiggs Series

The Jiggs series consists of somewhat excessively drained soils that are underlain by light-colored volcanic rocks. These soils are on uplands in the eastern part of the survey area from Viola to Big Bend. Slopes range from 10 to 70 percent. Elevation ranges from 2,500 to 6,500 feet. The annual precipitation is 40 to 50 inches, and the average annual air temperature is about 44° F. The 32° F. growing season is 100 to 150 days, and the 28° F. growing season is 125 to 175 days. The vegetation is mixed conifers and shrubs.

In a representative profile the surface layer is light brownish-gray and white, strongly acid and very strongly acid gravelly sandy loam about 12 inches thick. The subsoil is very pale brown, very strongly acid sandy loam about 11 inches thick. Fractured dacite rock is at a depth of about 23 inches, and hard dacite rock is at a depth of about 27 inches.

The areas of Jiggs soils are used as woodland and wildlife habitat and for water supply.

Representative profile of Jiggs gravelly sandy loam, 10 to 50 percent slopes, in Lyonsville-Jiggs complex, 10 to 50 percent slopes, about 1.6 miles south-southwest of Huckleberry Lake, at an elevation of 5,900 feet, in Latour State Forest. in the SW¼ sec. 17, T. 32 N., R. 3 E.:

O—1½ inches to 0, litter and humus; strongly acid.

A1—0 to 2 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) moist; strong, very fine, granular structure; soft, very friable, nonsticky and nonplastic; common roots; many very fine interstitial pores and few fine tubular pores; strongly acid; clear, irregular boundary.

A3—2 to 12 inches, white (10YR 8/2) gravelly sandy loam, brown (10YR 5/3) moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; common roots; many very fine interstitial pores and few fine tubular pores; very strongly acid; gradual, smooth boundary.

B2—12 to 23 inches, very pale brown (10YR 8/3) gravelly sandy loam, pale brown (10YR 6/3) moist; common, medium, distinct, yellow mottles when dry and common, medium, distinct, yellowish-brown mottles when moist; weak, fine, subangular blocky structure; soft, very friable, nonsticky and nonplastic; common roots; many very fine interstitial and tubular pores; very strongly acid; clear, wavy boundary.

C—23 to 27 inches, fractured dacite; some soil material along fracture planes; common roots between rock fragments; strongly acid; abrupt, irregular boundary.

R—27 inches, hard dacite.

The A horizon ranges from 10 to 20 inches in thickness, from grayish brown to light gray or white in color, from gravelly loamy sand to gravelly sandy loam in texture, and from medium acid to very strongly acid in reaction. The B2 horizon ranges from 10 to 20 inches in thickness, from light gray to very pale brown in color, from gravelly loamy sand to gravelly sandy loam in texture, and from medium acid to very strongly acid in reaction. The C horizon consists of soil material along fracture planes of weathered dacite rock. It ranges from 0 to 20 inches in thickness. Bedrock is at a depth of 20 to 60 inches. This soil generally is 20 to 40 inches deep; however, as it is mapped in the survey area, some areas are as much as 60 inches deep over hard bedrock.

In the survey area Jiggs soils are mapped only in complexes or undifferentiated groups with Lyonsville soils. They generally are near areas of Lyonsville, Nanny, and Windy soils.

Josephine Series

The Josephine series consists of well-drained soils that are underlain by sedimentary or metasedimentary rock. These soils are on uplands in the western and eastern parts of the survey area near Platina, Ono, French Gulch, Montgomery Creek, and Whitmore. Slopes range from 10 to 70 percent. Elevation ranges from 1,000 to 5,000 feet. The annual precipitation is 30 to 60 inches, and the average annual air temperature is about 50° F. The 32° F. growing season is 100 to 200 days, and the 28° F. growing season is 250 to 300 days. The vegetation is mixed conifers, oaks, shrubs, and grasses.

In a representative profile the surface layer is brown, slightly acid gravelly loam about 4 inches thick. The upper part of the subsoil is light-brown, medium acid and strongly acid gravelly clay loam. The lower part begins at a depth of about 45 inches and is light reddish-brown, strongly acid very stony clay loam. Shale and sandstone are at a depth of about 60 inches.

The areas of Josephine soils are used mainly as woodland, range, and wildlife habitat and for watershed. Small areas are used for orchards.

Representative profile of Josephine gravelly loam, 50 to 70 percent slopes, about 9 miles north of French Gulch in the SE¼ sec. 11, T. 34 N., R. 7 W.:

O1—2 inches to 0, leaves and twigs from Douglas-fir, black oak, and bracken fern.

A1—0 to 4 inches, brown (10YR 5/3) gravelly loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; slightly acid; clear, smooth boundary.

B1—4 to 24 inches, light-brown (7.5YR 6/4) gravelly clay loam, yellowish red (5YR 4/6) moist; moderate, medium, subangular blocky structure; slightly hard, friable,

slightly sticky and slightly plastic; few fine roots and common medium roots; many fine tubular pores and medium interstitial pores; few thin clay films; medium acid; gradual, wavy boundary.

B21t 24 to 45 inches, light-brown (7.5YR 6/4) gravely clay loam, dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; few fine roots and common medium roots; common fine tubular pores and many medium interstitial pores; few thin clay bridges and films; strongly acid; gradual, wavy boundary.

B22t—45 to 60 inches, light reddish-brown (5YR 6/4) very stony heavy clay loam, yellowish red (5YR 4/6) moist; reddish-yellow coatings; weak, coarse, subangular blocky structure; hard, firm, sticky and plastic; few medium roots; few fine tubular pores and very fine interstitial pores; common moderately thick clay films in pores and on ped faces; strongly acid; abrupt, irregular boundary.

C—60 inches, shale and sandstone.

The A horizon ranges from 4 to 20 inches in thickness, from reddish brown to brown or light yellowish brown in color, from gravelly sandy loam to gravelly loam in texture, and from slightly acid to strongly acid in reaction. The B1 horizon is 0 to 20 inches thick. The B2t horizon ranges from 20 to 50 inches in thickness, from light brown, light reddish brown, or yellowish red to reddish yellow in color, from gravelly clay loam to very stony clay loam in texture, and from medium acid to strongly acid in reaction. The C horizon is shale, sandstone, schist, or conglomerate and is at a depth of 24 to more than 60 inches. Where this soil is under a heavy coniferous vegetation, it has an organic O horizon that is ½ to 2 inches thick. Some areas of this soil are shallower to bedrock than the Josephine soil recognized elsewhere in California and in Oregon.

Josephine soils generally are near areas of Kilarc, Marpa, Maymen, Sites, Sheetiron, and Stonyford soils.

Josephine gravelly loam, 10 to 30 percent slopes (JbD).—This soil has moderate permeability. Runoff is medium to rapid, and the hazard of erosion is slight to moderate. Available water capacity is 6 to 9 inches. Bedrock is at a depth of 42 to more than 60 inches.

Included with this soil in mapping were small areas of Marpa, Sheetiron, and Sites soils.

This Josephine soil is used mainly as woodland, for limited grazing, as wildlife habitat, and for watershed. Small areas are used for orchards. Capability unit IVe–1 (22); range site, not assigned; woodland suitability group 2; wildlife group 8.

Josephine gravelly loam, 30 to 50 percent slopes (JbE).—This soil has moderate permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 6 to 9 inches. Bedrock is at a depth of 42 to more than 60 inches.

Included with this soil in mapping were small areas of Marpa, Sheetiron, and Sites soils.

This Josephine soil is used as woodland, for limited grazing, as wildlife habitat, and for watershed. Capability unit VIe–1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Josephine gravelly loam, 50 to 70 percent slopes (JbF).—This soil has the profile described as representative for the series. Permeability is moderate. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 6 to 9 inches. Bedrock is at a depth of 42 to more than 60 inches.

Included with this soil in mapping were areas of Marpa, Sheetiron, and Sites soils.

This Josephine soil is used as woodland, for limited grazing, as wildlife habitat, and for watershed. Capability unit VIIe–1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Josephine gravelly loam, moderately deep, 10 to 30 percent slopes (JdD).—This soil has a profile similar to the one described as representative for the series, except that bedrock is at a depth of 24 to 42 inches. Permeability is moderate. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 3.5 to 7 inches.

Included with this soil in mapping were small areas of Marpa, Sheetiron, and Sites soils.

This Josephine soil is used mainly as woodland, for limited grazing, as wildlife habitat, and for watershed. Small areas are used as irrigated pasture. Capability unit IVe–8(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Josephine gravelly loam, moderately deep, 30 to 50 percent slopes (JdE).—This soil has a profile similar to the one described as representative for the series, except that bedrock is at a depth of 24 to 42 inches. Permeability is moderate. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 3.5 to 7 inches.

Included with this soil in mapping were areas of Marpa, Sheetiron, and Sites soils.

This Josephine soil is used as woodland, for limited grazing, and for watershed. Capability unit VIe–1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Josephine-Sheetiron complex, 50 to 70 percent slopes (JsF).—About 60 percent of this complex is Josephine gravelly loam, 50 to 70 percent slopes, and about 40 percent is Sheetiron very stony loam, 50 to 75 percent slopes. Each of these soils has a profile similar to that described as representative for its respective series.

The Josephine soil has moderate permeability. Available water capacity is 6 to 10 inches. Bedrock is at a depth of 42 to more than 60 inches.

The Sheetiron soil is somewhat excessively drained and has moderately rapid permeability. Available water capacity is 2 to 3.5 inches. Fractured slate is at a depth of 18 to 30 inches.

Runoff is very rapid on the soils of this unit. The hazard of erosion is very high.

These soils are used as woodland and wildlife habitat and for watershed. Capability unit VIIs–1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Kanaka Series

The Kanaka series consists of well-drained and somewhat excessively drained soils that are underlain by granitic or metavolcanic rock. These soils are on uplands in the northwestern and north-central parts of the survey area near Shasta, Keswick, Project City, and Ingot. Slopes range from 3 to 70 percent. Elevation ranges from 700 to 1,500 feet. The annual precipitation is 40 to 60 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 225 days, and the 28° F. growing season is 300 to 350 days. The vegetation is manzanita and toyon and scattered oaks, Digger pine, and knobcone pine.

In a representative profile the surface layer is brown

and light yellowish-brown, medium acid and strongly acid cobbly sandy loam and sandy loam about 9 inches thick. The subsoil is very pale brown, strongly acid loam about 11 inches thick. The substratum is reddish-yellow, strongly acid sandy loam about 28 inches thick. Weathered granodiorite is at a depth of 48 inches.

The areas of Kanaka soils are used mainly as dryland pasture, range, and wildlife habitat and for watershed. Where irrigation water is available, small areas are used as irrigated pasture.

Representative profile of Kanaka cobbly sandy loam, 30 to 50 percent slopes, SE¼ sec. 36, T. 32 N., R. 6 W., 1¼ miles south of Old Shasta, on the Old Shasta-Muletown Road:

A11—0 to 2 inches, brown (10YR 5/3) cobbly sandy loam, dark brown (7.5YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots; many very fine tubular and interstitial pores; medium acid; abrupt, smooth boundary.

A12—2 to 9 inches, light yellowish-brown (10YR 6/4) sandy loam, brown (7.5YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many fine and medium tubular and interstitial pores; strongly acid; gradual, smooth boundary.

B2—9 to 20 inches, very pale brown (10YR 7/4) light loam, strong brown (7.5YR 4/6) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine, fine, and medium roots; many very fine tubular and interstitial pores; very few thin clay films in pores; strongly acid; clear, irregular boundary.

C—20 to 48 inches, reddish-yellow (7.5YR 6/6) sandy loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots; few thin clay films as bridges; strongly acid; gradual, wavy boundary.

R—48 inches, weathered granodiorite; common thin clay films along fracture planes.

The A horizon ranges from 7 to 15 inches in thickness and is very pale brown, light yellowish brown, grayish brown, brown, or reddish yellow in color. The B2 horizon ranges from 10 to 18 inches in thickness, from pink to very pale brown in color, from sandy loam to heavy loam in texture, and from strongly acid to very strongly acid in reaction. The C horizon is 3 to 30 inches thick. Weathered granodiorite rock is at a depth of 20 to 50 inches.

Kanaka soils generally are near areas of Auberry, Chaix, Diamond Springs, and Goulding soils.

Kanaka sandy loam, 3 to 15 percent slopes (KbC).—This soil is well drained. Permeability is moderately rapid. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 4 to 7 inches. Weathered bedrock is at a depth of 36 to 50 inches.

Included with this soil in mapping were small areas of Auberry, Diamond Springs, and Chaix soils.

This Kanaka soil is used as range, dryland pasture, and wildlife habitat and for watershed. If water is available, small areas are used as irrigated pasture. Capability unit IVe–8(17, 18); Granitic range site; woodland suitability group, not assigned; wildlife group 5.

Kanaka rocky sandy loam, 5 to 30 percent slopes (KcD).—This soil is well drained. Permeability is moderately rapid. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 3.5 to 7 inches. Weathered bedrock is at a depth of 30 to 50 inches. Rock outcrops cover 2 to 10 percent of the surface.

Included with this soil in mapping were small areas of Auberry, Chaix, and Diamond Springs soils.

This Kanaka soil is used as range, dryland pasture, and wildlife habitat and for watershed. Capability unit VIe–1(15, 17, 18); Granitic range site; woodland suitability group, not assigned; wildlife group 5.

Kanaka rocky sandy loam, 30 to 50 percent slopes (KcE).—This soil has the profile described as representative for the series. It is somewhat excessively drained. Permeability is moderately rapid. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 2 to 7 inches. Weathered bedrock is at a depth of 20 to 50 inches. Exposed bedrock outcrops cover 2 to 10 percent of the surface.

Included with this soil in mapping were areas of Auberry, Chaix, and Diamond Springs soils.

This Kanaka soil is used as range and wildlife habitat and for watershed. Capability unit VIIe–1(15, 18); Granitic range site; woodland suitability group, not assigned; wildlife group 5.

Kanaka rocky sandy loam, 50 to 70 percent slopes, eroded (KcF2).—This soil is somewhat excessively drained and has moderately rapid permeability. Runoff is very rapid, and the hazard of further erosion is very high. Available water capacity is 2 to 5 inches. Weathered bedrock is at a depth of 20 to 40 inches. Exposed bedrock outcrops cover 2 to 10 percent of the surface.

Included with this soil in mapping were areas of Auberry, Chaix, and Diamond Springs soils.

This Kanaka soil is used as range and wildlife habitat and for watershed. Capability unit VIIe–1(15, 18); Granitic range site; woodland suitability group, not assigned; wildlife group 5.

Keefers Series

The Keefers series consists of well-drained soils that formed in old alluvium from basic volcanic rock. They are on terraces in the east-central part of the survey area from Balls Ferry Bridge to Oak Run. Slopes are 0 to 8 percent. Elevation ranges from 500 to 1,000 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 225 to 250 days, and the 28° F. growing season is 275 to 300 days. The vegetation is annual grasses, forbs, and scattered blue oak.

In a representative profile the surface layer is brown, medium acid gravelly loam and clay loam about 14 inches thick. The upper part of the subsoil is brown, medium acid clay loam about 7 inches thick. The next part is reddish-brown, slightly acid very gravelly light clay. At a depth of about 26 inches, the subsoil becomes mixed pinkish-gray, strong-brown, and black, slightly acid, weakly cemented very gravelly clay.

The areas of Keefers soils are used for field crops and as dryland pasture.

Representative profile of Keefers gravelly loam, 0 to 3 percent slopes, about 4.25 miles south of Millville, 500 feet northwest of the southeast corner of sec. 33, T. 31 N., R. 3 W.:

A11—0 to 7 inches, brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 3/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular and interstitial pores; most pebbles are on the surface and form a gravel pavement; medium acid; clear, smooth boundary.

A12—7 to 14 inches, brown (7.5YR 5/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate, fine, granular

structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular and interstitial pores and few fine tubular pores; few thin clay films in pores; few rodent holes about 1 inch in diameter; medium acid; gradual, smooth boundary.

B1t—14 to 21 inches, brown (7.5YR 5/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular and interstitial pores and few fine tubular pores; many thin clay films in pores and on ped faces; medium acid; abrupt, wavy boundary.

IIB21t—21 to 26 inches, reddish-brown (5YR 4/4) dry or moist very gravelly light clay; moderate, subangular blocky structure; very hard, brittle, firm, slightly sticky and plastic; few very fine tubular pores and common medium interstitial pores; few thick and many moderately thick clay films in pores and on ped faces; slightly acid; gradual, smooth boundary.

IIB22t—26 to 60 inches, mixed pinkish-gray, strong-brown, and black (7.5YR 6/2, 5/6; 2/0) very gravelly light clay, dark brown (7.5YR 4/4) moist; massive; weakly cemented, extremely hard, firm, slightly sticky and plastic; few fine interstitial pores; many thick clay films in pores and as bridges; slightly acid.

The A horizon ranges from 10 to 15 inches in thickness, from brown to dark grayish brown in color, and from slightly acid to medium acid in reaction. The IIB2t horizon ranges from very gravelly clay to very gravelly clay loam in texture and from medium acid to neutral in reaction. Weakly cemented, unrelated, older alluvial material is at a depth of 24 to 42 inches.

Keefers soils generally are near areas of Inks, Pentz, Supan, Toomes, and Tuscan soils.

Keefers gravelly loam, 0 to 3 percent slopes (KdA).—This soil has the profile described as representative for the series. Permeability is slow. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 4 to 7.5 inches. A weakly cemented substratum is at a depth of 24 to 42 inches and limits root penetration in places.

Included with this soil in mapping were small areas of Inks, Supan, and Tuscan soils.

This Keefers soil is used mainly for irrigated hay and as irrigated and dryland pasture. Some areas are used for irrigated crops and orchards. Capability unit IIIs-3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 5.

Keefers gravelly loam, 3 to 8 percent slopes (KdB).—This soil has slow permeability. Surface runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 4 to 7.5 inches. The weakly cemented substratum is at a depth of 24 to 42 inches and limits root penetration in places.

Included with this soil in mapping were small areas of Keefers cobbly loam and areas of Inks, Supan, and Tuscan soils.

This Keefers soil is used as dryland pasture. Small areas are irrigated. Capability unit IIIe-3(17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 5.

Keefers cobbly loam, channeled, 1 to 5 percent slopes (KeB).—This soil is in watercourses in valleys. It is subject to intermittent flooding caused by runoff water from adjacent areas. Permeability is slow. Runoff is slow, except from adjacent areas. The hazard of erosion is slight, except in channels where it is high. Available water capacity is 3 to 6 inches. The weakly cemented substratum is at a depth of 24 to 42 inches and limits root penetration in places. This soil is cobbly throughout.

Included with this soil in mapping were small areas of a deep, noncobbly soil that formed in alluvium and areas of Cobbly alluvial land, frequently flooded.

This Keefers soil is used mainly as dryland pasture. A few small areas are used as irrigated pasture. Capability unit IVw-2(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 5.

Kidd Series

The Kidd series consists of somewhat excessively drained soils that are underlain by rhyolite or tuff. These soils are on uplands in the western part of the survey area near Whiskeytown Lake. Slopes range from 10 to 60 percent. Elevation ranges from 1,000 to 2,000 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 55° F. The 32° F. growing season is 200 to 225 days, and the 28° F. growing season is 275 to 300 days. The vegetation is manzanita, poison oak, toyon, yerba santa, knobcone pine, Digger pine, and oaks.

In a representative profile the surface layer is dark-gray and light brownish-gray, medium acid and strongly acid gravelly loam about 8 inches thick. The substratum is pale-brown, strongly acid very gravelly loam. Fractured, hard, rhyolite bedrock is at a depth of about 16 inches.

The areas of Kidd soils are used for watershed and as range and wildlife habitat.

Representative profile of Kidd very rocky loam, 10 to 60 percent slopes, eroded, 1/4 mile east of Whiskey Creek Bridge on the south side of State Route 299 in sec. 16, T. 32 N., R. 6 W.:

A11—0 to 3 inches, dark-gray (10YR 4/1) gravelly loam, black (10YR 2/1) moist; moderate, fine, granular structure; soft, very friable, nonsticky and slightly plastic; common very fine and few fine roots; many very fine interstitial and tubular pores; medium acid; clear, smooth boundary.

A12—3 to 8 inches, light brownish-gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine and few fine roots; many very fine interstitial and tubular pores; strongly acid; clear, smooth boundary.

C—8 to 16 inches, pale-brown (10YR 6/3) very gravelly loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine and few fine roots; many fine interstitial and tubular pores; strongly acid; gradual, irregular boundary.

R—16 inches, fractured hard rhyolite (schistose); roots and and material from C horizon between fractures.

The A horizon ranges from 4 to 8 inches in thickness and is gravelly sandy loam or gravelly loam in texture. The C horizon ranges from 3 to 13 inches in thickness, from dark grayish brown to pale brown in color, from gravelly sandy loam to very gravelly loam in texture, and from strongly acid to very strongly acid in reaction. Fractured hard rhyolite or tuff bedrock is at a depth of 7 to 17 inches.

Kidd soils generally are near areas of Auburn, Behemotosh, Boomer, Chaix, Diamond Springs, Goulding, and Neuns soils

Kidd very rocky loam, 10 to 60 percent slopes, eroded (KgF2).—This is the only Kidd soil mapped in the survey area. It has moderately rapid permeability. Runoff is medium to very rapid, and the hazard of further erosion is moderate to very high. Available water capacity is 0.75 to 2.5 inches. Fractured rhyolite is at a depth of 7 to 17

inches. Exposed bedrock outcrops cover 10 to 25 percent of the surface.

Included with this soil in mapping were small areas of Behemotosh, Boomer, and Neuns soils. Also included were some areas of severely eroded soils that are less than 7 inches deep over fractured rhyolite.

This Kidd soil is used as range and wildlife habitat and for watershed. Capability units VIIs–1(15, 17, 18); Very Shallow Very Rocky range site; woodland suitability group, not assigned; wildlife group 6.

Kilarc Series

The Kilarc series consists of moderately well drained soils underlain by sandstone, shale, or conglomerate. They are on uplands in the eastern part of the survey area near Millville, Shingletown, Whitmore, Montgomery Creek, and Big Bend. Slopes range from 2 to 50 percent. Elevation ranges from 600 to 3,000 feet. The annual precipitation is 35 to 70 inches, and the average annual air temperature is about 54° F. The 32° F. growing season is 150 to 225 days, and the 28° F. growing season is 250 to 325 days. The vegetation is blue oak, Garry oak, interior live oak, Digger pine, whiteleaf manzanita, poison oak, and annual and perennial grasses.

In a representative profile the surface layer is grayish-brown, slightly acid very stony light loam and sandy clay loam about 9 inches thick. The upper part of the subsoil is light brownish-gray and pale-brown, extremely acid clay about 13 inches thick. The lower part of the subsoil is pale-brown, extremely acid clay loam about 12 inches thick. Below this, the substratum is light-gray, very strongly acid sandy clay loam. Unaltered weakly consolidated sandstone is at a depth of 44 inches.

Kilarc soils are subject to landslip. The areas of these soils are used as range, pasture, and wildlife habitat and for watershed.

Representative profile of Kilarc very stony sandy clay loam, 10 to 30 percent slopes, about 2½ miles west of Whitmore on Whitmore Road in the NW¼ sec. 23, T. 32 N., R. 1 W.:

A1—0 to 3 inches, grayish-brown (10YR 5/2) very stony sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine roots; many very fine interstitial pores; slightly acid; clear, smooth boundary.

A3—3 to 9 inches, grayish-brown (10YR 5/2) sandy clay loam, dark brown (7.5YR 3/2) moist; massive; hard, friable, slightly sticky and plastic; common very fine and fine roots; many very fine tubular and interstitial pores; slightly acid; abrupt, wavy boundary.

B21t—9 to 16 inches, light brownish-gray (10YR 6/2) clay, brown (7.5YR 4/2) moist; moderate, coarse, prismatic structure; extremely hard, very firm, very plastic and sticky; common very fine roots, few fine roots, and many medium roots; few very fine tubular and interstitial pores; continuous moderately thick clay films on ped faces; extremely acid; clear, smooth boundary.

B22t—16 to 22 inches, pale brown (10YR 6/3) clay, brown (7.5YR 4/3) moist; massive parting to moderate, medium, subangular blocky structure; extremely hard, very firm, very plastic and sticky; common very fine roots, few fine roots, and many medium roots; common very fine tubular and interstitial pores; many moderately thick clay films on ped faces and as bridges; extremely acid; gradual, smooth boundary.

B3—22 to 34 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; massive; very hard, friable, sticky and plastic; few very fine, fine, and medium roots; common very fine tubular pores and many very fine interstitial pores; many moderately thick clay films as bridges; extremely acid; gradual, smooth boundary.

C1—34 to 44 inches, light-gray (2.5Y 7/2) sandy clay loam, olive brown (2.5Y 4/4) moist; common, medium, distinct, light brownish-gray mottles; massive; hard, friable, slightly sticky and plastic; few fine roots; common very fine tubular pores; common moderately thick clay films in pores; very strongly acid; very gradual, wavy boundary.

C2—44 inches, unaltered weakly consolidated sandstone.

The A horizon ranges from 3 to 10 inches in thickness, from grayish brown to light olive brown in color, from heavy sandy loam to gravelly sandy clay loam in texture, and from slightly acid to medium acid in reaction. The B2t horizon ranges from 12 to 40 inches in thickness, from grayish brown or light brownish gray to light yellowish brown in color, from sandy clay to clay in texture, and from very strongly acid to extremely acid in reaction. The B3 horizon is 10 to 16 inches thick. The C1 horizon, where present, very gradually changes to unaltered weakly consolidated sandstone at a depth of 25 to 45 inches.

Kilarc soils generally are near areas of Aiken, Cohasset, Geunoc, Inks, Parrish, Marpa, Sites, Supan, and Toomes soils.

Kilarc sandy clay loam, 2 to 15 percent slopes (KhC).—This soil has slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 4 to 8 inches. Sandstone is at a depth of 25 to 45 inches.

Included with this soil in mapping were small areas of Inks, Parrish, Sites, and Supan soils.

This Kilarc soil is used mainly as range and dryland pasture. Small areas are used as irrigated pasture. Capability unit IIIe–3(17, 22); Fine Loamy range site; woodland suitability group, not assigned; wildlife group, not assigned.

Kilarc sandy clay loam, 15 to 30 percent slopes (KhD).—This soil has slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 4 to 8 inches. Sandstone is at a depth of 25 to 45 inches.

Included with this soil in mapping were small areas of Inks, Parrish, Sites, and Supan soils.

This Kilarc soil is used as range and dryland pasture. Capability unit IVe–3(17, 18, 22); Fine Loamy range site; woodland suitability group, not assigned; wildlife group, not assigned.

Kilarc sandy clay loam, 30 to 50 percent slopes (KhE).—This soil has slow permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 4 to 8 inches. Sandstone is at a depth of 25 to 45 inches.

Included with this soil in mapping were small areas of Inks, Parrish, Sites, and Supan soils.

This Kilarc soil is used as range and wildlife habitat and for watershed. Capability unit VIe–1(22); Fine Loamy range site; woodland suitability group, not assigned; wildlife group, not assigned.

Kilarc very stony sandy clay loam, 10 to 30 percent slopes (KlD).—This soil has the profile described as representative for the series. Permeability is slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 4 to 8 inches. Sandstone is at a depth of 25 to 45 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Inks, Parrish, Sites, and Supan soils.

This Kilarc soil is used as range and wildlife habitat and for watershed. Capability unit VIs–1(22); Fine Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Kilarc very stony sandy clay loam, 30 to 50 percent slopes (KlE).—This soil has slow permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 4 to 8 inches. Sandstone is at a depth of 25 to 45 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Inks, Parrish, Sites, and Supan soils.

This Kilarc soil is used as range and wildlife habitat and for watershed. Capability unit VIs–1(22); Fine Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Kilarc-Sites complex, 8 to 30 percent slopes (KsD).—About 55 percent of this complex is Kilarc very stony sandy clay loam, 10 to 30 percent slopes, and about 40 percent is Sites stony loam, 8 to 30 percent slopes. The remaining 5 percent consists of inclusions of Supan soils. The Kilarc and the Sites soil each has a profile similar to that described as representative for its respective series.

The Kilarc soil has slow permeability. Available water capacity is 6 to 12 inches. Sandstone is at a depth of 25 to 45 inches. Stones cover 3 to 15 percent of the surface.

The Sites soil has moderately slow permeability. Available water capacity is 7 to 12 inches. Weathered sandstone is at a depth of 48 to more than 60 inches. Stones cover 1 to 3 percent of the surface.

Runoff is medium to rapid on the soils of this unit. The hazard of erosion is moderate to high.

The areas of these soils are used as range and woodland. They are also used for watershed and as wildlife habitat. Capability unit VIs–1(22); Fine Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Landslides

Landslides (LaE) consist of masses of rock fragments, soil, and rubble that have slid down slopes in geologically recent times. Scarred surfaces resulting from the slides are included. This land type is in the mountainous eastern and western parts of the survey area, mainly near areas of Josephine, Behemotosh, Kilarc, and Sites soils. Slopes are moderately steep to very steep. The vegetation is similar to that on adjacent soils.

Landslides have a gravelly to stony mixture of soil material and are underlain by broken rock. They are well drained, except for a few wet spots.

This land type is used for recreation and water supply. Capability unit VIIIs–1(15, 18, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 5.

Lodo Series

The Lodo series consists of somewhat excessively drained soils that are underlain by shale. These soils are on uplands in areas of the Bald Hills in the western part of the survey area and east of Millville in the eastern part. Slopes range from 10 to 70 percent. Elevation ranges from 650 to 1,000 feet. The annual precipitation is 30 to 35 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 275 to 300 days. The vegetation is annual grasses and forbs and scattered ceanothus, Digger pine, and oaks in some areas.

In a representative profile the surface layer is grayish-brown, slightly acid shaly loam about 10 inches thick. Shale is at a depth of 10 inches.

The areas of Lodo soils are used as range and wildlife habitat and for water supply.

Representative profile of Lodo shaly loam, 10 to 50 percent slopes, about 6½ miles southwest of Ono in the southern half of the NE¼ sec. 26, T. 30 N., R. 8 W.:

A11—0 to 3 inches, grayish-brown (10YR 5/2) shaly loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; soft, friable, nonplastic and slightly sticky; common roots; slightly acid; clear, smooth boundary.

A12—3 to 10 inches, grayish-brown (10YR 5/2) shaly loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure; soft, friable, nonplastic and slightly sticky; few roots; slightly acid; clear, wavy boundary.

R—10 inches, shale.

The A horizon ranges from 4 to 12 inches in thickness, from grayish brown to brown in color, from shaly loam to shaly light clay loam in texture, and from neutral to medium acid. Fractured shale is at a depth of 4 to 12 inches.

Lodo soils generally are near areas of Gaviota, Millsap, Millsholm, Parrish, Sehorn, Sheetiron, and Tehama soils.

Lodo shaly loam, 10 to 50 percent slopes (LbE).—This soil has the profile described as representative for the series. Permeability is moderate. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 0.3 to 1.5 inches. Shale is at a depth of 4 to 12 inches.

Included with this soil in mapping were small areas of Gaviota, Millsholm, and Sehorn soils.

This Lodo soil is used as range and wildlife habitat and for watershed. Capability unit VIIs–1(15, 17, 18); Very Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 3.

Lodo shaly loam, 50 to 70 percent slopes, severely eroded (LbF3).—This soil has moderate permeability. Runoff is very rapid, and the hazard of further erosion is very high. Available water capacity is 0.3 to 1 inch. Shale is at a depth of 4 to 8 inches.

Included with this soil in mapping were small areas of Gaviota, Millsholm, and Sehorn soils.

This Lodo soil is used for recreation and watershed and as wildlife habitat. Capability unit VIIIs–1(15, 18, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 3.

Los Robles Series

The Los Robles series consists of well drained and moderately well drained soils that formed in alluvium from dominantly basic rock. These soils are on low terraces and fans along the streams in the east-central part of the survey area from Anderson and Bella Vista east to Whitmore and Round Mountain. Slopes are 0 to 8 percent. Elevation ranges from 400 to 900 feet. The annual precipitation is 30 to 50 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 250 to 325 days. The veg-

etation is valley oak, interior live oak, blue oak, annual grasses, and Digger pine.

In a representative profile the surface layer is dark grayish-brown, slightly acid loam about 8 inches thick. The subsoil is dark grayish-brown and grayish-brown, slightly acid loam and heavy loam. At a depth of about 54 inches, the subsoil grades to a substratum of grayish-brown, neutral heavy sandy loam that extends to a depth of more than 60 inches.

The areas of Los Robles soils are used for field crops.

Representative profile of Los Robles loam, 0 to 3 percent slopes, near Cow Creek, 2¼ miles south of Palo Cedro, 1,100 feet north of W¼ corner sec. 20, T. 31 N., R. 3 E.:

Ap1—0 to 1 inch, dark grayish-brown (10YR 4/2) light loam, very dark grayish brown (10YR 3/2) moist; weak, medium, granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

Ap2—1 to 8 inches, dark grayish-brown (10YR 4/2) light loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, nonsticky and nonplastic; many very fine roots; many very fine tubular and interstitial pores; about 3 rodent holes, 1 inch in diameter, per square foot; slightly acid; clear, smooth boundary.

B1—8 to 16 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable, nonsticky and slightly plastic; many very fine and few fine horizontal roots; many very fine tubular and interstitial pores and few fine horizontal pores; common thin clay films in pores; slightly acid; gradual, smooth boundary.

B21t—16 to 25 inches, dark grayish-brown (10YR 4/2) heavy loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine tubular and interstitial pores and few fine tubular pores; common thin clay films in pores and as bridges; slightly acid; gradual, smooth boundary.

B22t—25 to 40 inches, dark grayish-brown (10YR 4/2) heavy loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; very hard, friable, slightly sticky and plastic; few very fine and fine roots; many very fine tubular and interstitial pores and few fine tubular pores; many thin clay films in pores and as bridges; slightly acid; gradual, smooth boundary.

B3t—40 to 54 inches, grayish-brown (2.5Y 5/2) heavy loam, dark grayish brown (10YR 4/2) moist; massive; very hard, friable, slightly sticky and slightly plastic; many very fine and few fine roots; many very fine tubular and interstitial pores and few fine tubular pores; few thin clay films in pores; slightly acid; gradual, smooth boundary.

C1—54 to 65 inches, grayish-brown (2.5Y 5/2) heavy sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable, nonsticky and nonplastic; few very fine and fine roots; many very fine tubular and interstitial pores and few fine tubular pores; very few thin clay films in pores; neutral; clear, smooth boundary.

C2—65 to 72 inches, grayish-brown (2.5Y 5/2) loamy sand, very dark grayish brown (2.5Y 3/2) moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine and fine roots; many very fine tubular and interstitial pores and few fine tubular pores; neutral.

The A horizon ranges from 6 to 18 inches in thickness, from dark grayish brown to brown in color, from loam to light loam in texture, and from neutral to medium acid in reaction. A few flecks of muscovite mica are below a depth of 16 inches. The B2t horizon ranges from 24 to 40 inches in thickness, from dark grayish brown to brown in color, from heavy loam to clay loam in texture, and from neutral to slightly acid in reaction. The C horizon ranges from yellowish brown to grayish brown in color, from loamy sand to sandy loam in texture, and from neutral to slightly acid in reaction. Consolidated tuffaceous material is at a depth of more than 5 feet.

Los Robles soils generally are near areas of Hillgate, Honn, Inks, Molinos, Myers, Spreckels, Supan, and Vina soils.

Los Robles loam, 0 to 3 percent slopes (LcA).—This soil has the profile described as representative for the series. It is well drained. Permeability is moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 9 to 11 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Honn, Molinos, and Vina soils.

This Los Robles soil is used mainly for irrigated hay and as irrigated and dryland pasture. Small areas are used for irrigated crops and orchards. Capability unit I–1(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Los Robles loam, 3 to 8 percent slopes (LcB).—This soil is well drained and has moderately slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 9 to 11 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of Honn, Molinos, and Vina soils.

This Los Robles soil is used for irrigated hay and as irrigated and dryland pasture. Small areas are used for irrigated crops and orchards. Capability unit IIe–1(17, 18); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Los Robles loam, seeped, 0 to 3 percent slopes (LdA).—This soil is on low terraces adjacent to perennial streams. It is moderately well drained. The profile is similar to the one described as representative of the series, except that the subsoil is mottled, dark grayish brown and grayish brown. Permeability is moderately slow. Water tends to pond on the surface and to remain in this soil longer than in other Los Robles soils. The hazard of erosion is none. Available water capacity is 9 to 11 inches.

Included with this soil in mapping were small areas of Honn, Molinos, and Vina soils and of Cobbly alluvial land, frequently flooded.

This Los Robles soil is used mostly for irrigated hay and as irrigated dryland pasture. Small areas are used for irrigated crops. Capability unit IIw–2 (17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Los Robles loam, moderately deep, 0 to 5 percent slopes (LeB).—This soil has a profile similar to the one described as representative for the series, except that it is 24 to 48 inches deep over unrelated hard lava. This soil is moderately well drained. Permeability is moderately slow. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 4 to 8 inches.

Included with this soil in mapping were small areas of Honn, Molinos, and Vina soils.

This Los Robles soil is used for irrigated hay and as irrigated and dryland pasture. Small areas are used for irrigated crops. Capability unit IIIe–1 (17, 18); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Los Robles gravelly loam, 0 to 3 percent slopes (LfA).—This soil has a profile similar to the one described as representative for the series, except that the content of

gravel is 15 to 30 percent throughout the profile. This soil is well drained, and permeability is moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 7 to 9 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Honn, Molinos, and Vina soils.

This Los Robles soil is used mainly for irrigated and dryland hay and as irrigated pasture. Small areas are used for crops. Capability unit IIs–4(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Lyonsville Series

The Lyonsville series consists of well-drained soils that are underlain by light-colored volcanic rock. These soils are on uplands in the eastern part of the survey area from the Tehama County line to Big Bend. Slopes range from 10 to 70 percent. Elevation ranges from 2,500 to 6,500 feet. The annual precipitation is 40 to 50 inches, and the average annual air temperature is about 44° F. the 32° F. growing season is 100 to 150 days, and the 28° F. growing season is 125 to 175 days. The vegetation is mixed conifers and shrubs.

In a representative profile the surface layer is brown, strongly acid very stony sandy loam and pale-brown, strongly acid gravelly sandy clay loam about 18 inches thick. The subsoil is very pale brown, very strongly acid and strongly acid gravelly sandy clay loam. The substratum at a depth of 30 inches is light-gray, strongly acid very gravelly heavy sandy loam. Weathered dacite is at a depth of 33 inches.

The areas of Lyonsville soils are used as woodland and wildlife habitat and for water supply.

Representative profile of Lyonsville very stony sandy loam, 10 to 50 percent slopes, in an area of Lyonsville-Jiggs complex, 10 to 50 percent slopes, in Latour State Forest on Rim Road, 2½ miles northeast of Latour Butte Lookout in SE¼SW¼ sec. 17, T. 32 N., R. 3 E.:

O1—3 inches to 1 inch, litter from woody shrubs and conifer cover.

O2—1 inch to 0, humus.

A11—0 to 1 inch, brown (10YR 5/3) very stony sandy loam, dark brown (10YR 3/3) moist; strong, very fine, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine roots and few fine and coarse roots; many very fine interstitial pores; strongly acid; abrupt, smooth boundary.

A12—1 to 12 inches, pale-brown (10YR 6/3) gravelly light sandy clay loam, dark grayish brown (10YR 4/2) moist; strong, very fine, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine roots and few fine and coarse roots; many very fine interstitial pores; strongly acid; clear, smooth boundary.

A13—12 to 18 inches, pale-brown (10YR 6/3) gravelly sandy clay loam, dark brown (10YR 4/3) moist; strong, very fine, granular structure; soft, very friable, nonsticky and slightly plastic; common very fine roots and few fine and coarse roots; many very fine interstitial pores; strongly acid; clear, smooth boundary.

B21—18 to 25 inches, very pale brown (10YR 7/3) gravelly sandy clay loam, dark grayish brown (10YR 4/2) moist; brownish-yellow stains; strong, very fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; common very fine roots and few fine and coarse roots; many very fine interstitial pores; very few thin clay films in pores; very strongly acid; abrupt, smooth boundary.

B22—25 to 30 inches, very pale brown (10YR 8/4) gravelly sandy clay loam, brown (10YR 5/3) moist; strong, very fine, granular structure; slightly hard, friable, nonsticky and slightly plastic; common very fine roots and few fine and medium roots; many very fine interstitial pores; very few thin clay films in pores; strongly acid; clear, smooth boundary.

C—30 to 33 inches, light gray (10YR 7/2) very gravelly heavy sandy loam, brown (10YR 5/3) moist; massive; very hard, very firm nonsticky, slightly plastic; very few, fine, flattened roots; many very fine vesicular and interstitial pores; strongly acid; clear, smooth boundary.

R—33 inches, weathered dacite; some soil material in fracture planes; massive.

The A horizon ranges from 10 to 20 inches in thickness, from grayish brown or brown to light yellowish brown or pale brown in color, from gravelly sandy clay loam to very stony sandy loam in texture, and from slightly acid to strongly acid in reaction. The B2 horizon ranges from 10 to 20 inches in thickness, from light yellowish brown to very pale brown in color, from gravelly heavy sandy loam to sandy clay loam in texture, and from medium acid to very strongly acid in reaction. The C horizon ranges from 3 to 20 inches in thickness, and from gravelly sandy loam to very gravelly sandy loam in texture. Rhyolite, dacite, or andesite rock is at a depth of 20 to 60 inches. This soil is 20 to 40 inches deep in most places; however, as mapped in the Shasta Area, some areas are as deep as 60 inches over hard rock.

In Shasta County Area Lyonsville soils are mapped only in complexes or in undifferentiated units with Jiggs soils.

Lyonsville Jiggs complex, 10 to 50 percent slopes (LgE).—About 45 percent of this complex is Lyonsville very stony sandy loam, 10 to 50 percent slopes, and about 45 percent is Jiggs gravelly sandy loam, 10 to 50 percent slopes. The remaining 10 percent consists of inclusions of Windy soils. The Lyonsville and the Jiggs soil each has the profile described as representative for its respective series.

The Lyonsville soil has moderate permeability. Available water capacity is 2 to 5 inches. Weathered dacite is at a depth of 20 to 40 inches. Stones and cobblestones cover 3 to 15 percent of the surface.

The Jiggs soil has moderately rapid permeability. Available water capacity is 2 to 4 inches. Dacite is at a depth of 20 to 40 inches. Exposed dacite bedrock outcrops cover 5 to 10 percent of the surface.

Runoff is medium to rapid on the soils of this unit. The hazard of erosion is moderate to high.

The areas of these soils are used as woodland and wildlife habitat and for watershed. Capability unit VIs–1 (22); range site, not assigned; woodland suitability group 5; wildlife group 9.

Lyonsville-Jiggs complex, deep, 10 to 50 percent slopes (LhE).—About 45 percent of this complex is Lyonsville very stony sandy loam, deep, 10 to 50 percent slopes, and about 45 percent is Jiggs gravelly sandy loam, deep, 10 to 50 percent slopes. The remaining 10 percent consists of inclusions of Windy soils and grayish-brown soils that formed on volcanic rocks. The Lyonsville and the Jiggs soil each has a profile similar to that described as representative for its respective series.

The Lyonsville soil has moderate permeability. Available water capacity is 4 to 7 inches. Stones cover 3 to 15 percent of the surface.

The Jiggs soil has moderately rapid permeability. Available water capacity is 3 to 6.5 inches. Exposed

dacite bedrock outcrops cover 5 to 10 percent of the surface.

Runoff is medium to rapid on the soils of this unit. The hazard of erosion is moderate to high. Both the Lyonsville and the Jiggs soils are 40 to 60 inches deep, which is deeper than the soils of their respective series recognized elsewhere in California.

The areas of these soils are used as woodland and wildlife habitat and for watershed. Capability unit VIs-1(22); range site, not assigned; woodland suitability group 3; wildlife group 8.

Lyonsville and Jiggs soils, 50 to 70 percent slopes (LkF).—This undifferentiated group consists of areas of Lyonsville very stony sandy loam, 50 to 70 percent slopes, and Jiggs rocky sandy loam, 50 to 70 percent slopes. The Lyonsville soil is on the lower parts of the slopes, and the Jiggs soil is on the upper or higher parts. The proportion of each soil varies from one area to another, but each soil generally makes up about 45 percent of the group. The remaining 10 percent consists mainly of inclusions of Windy soils. The Lyonsville and the Jiggs soil each has a profile similar to that described as representative for its respective series.

The Lyonsville soil has moderate permeability. Available water capacity is 2 to 5 inches. Stones cover 3 to 10 percent of the surface.

The Jiggs soil has moderately rapid permeability. Available water capacity is 2 to 4 inches. Exposed dacite bedrock outcrops cover 5 to 10 percent of the surface.

Runoff is very rapid on the soils of this group. The hazard of erosion is very high. Both soils are 20 to 40 inches deep to bedrock.

The areas of these soils are used as woodland and wildlife habitat and for watershed and recreation. Capability unit VIIs-1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Marpa Series

The Marpa series consists of well-drained soils that are underlain by shale or slate. These soils are on uplands in the north-central part of the survey area near French Gulch, Bella Vista, and Ingot. Slopes range from 30 to 75 percent. Elevation ranges from 800 to 4,500 feet. The annual precipitation is 40 to 50 inches, and the average annual air temperature is about 56° F. The 32° F. growing season is 150 to 250 days, and the 28° F. growing season is 200 to 300 days. The vegetation is mixed conifers, oaks, and shrubs.

In a representative profile the surface layer is brown, slightly acid gravelly loam about 6 inches thick. The upper part of the subsoil is brown, slightly acid gravelly loam about 7 inches thick. The lower part of the subsoil is light-brown, strongly acid very gravelly clay loam. Fractured shale is at a depth of about 26 inches.

The areas of Marpa soils are used as woodland and wildlife habitat and for watershed.

Representative profile of Marpa gravelly loam, 50 to 75 percent slopes, about three-fourths mile north of the Mineral School near N¼ corner of sec. 31, T. 34 N., R. 1 W.:

O—1 inch to 0, litter and humus from black oak and Douglas-fir.

A1—0 to 6 inches, brown (7.5YR 5/2) gravelly heavy loam, dark reddish brown (5YR 3/3) moist; moderate, medium, granular structure; soft, very friable, nonsticky and nonplastic; many fine roots, common medium roots, and few coarse roots; many very fine interstitial pores and few fine and medium tubular pores; few, thin, discontinuous clay films; slightly acid; gradual, wavy boundary.

B1—6 to 13 inches, brown (7.5YR 5/4) gravelly heavy loam, dark reddish brown (5YR 3/4) moist; weak, medium, granular structure; soft, friable, nonsticky and nonplastic; common fine and medium roots and few coarse roots; common very fine interstitial pores and few fine and medium tubular pores; common, thin, discontinuous clay films; slightly acid; gradual, wavy boundary.

B2t—13 to 26 inches, light-brown (7.5YR 6/4) very gravelly clay loam, brown (7.5YR 4/4) moist; massive; soft, friable, nonsticky and nonplastic; few fine and medium roots; common very fine interstitial pores and few fine and medium tubular pores; common, discontinuous, thick clay films; strongly acid; abrupt, smooth boundary.

R—26 inches, fractured shale.

The A horizon ranges from 3 to 14 inches in thickness, from brown to pinkish gray in color, and from slightly acid to medium acid in reaction. The B1 horizon is 7 to 12 inches thick. The B2t horizon ranges from 12 to 26 inches in thickness, from light brown to pink in color, and from gravelly loam to very gravelly clay loam in texture. Shattered shale bedrock is at a depth of 20 to 40 inches.

Marpa soils generally are near areas of Auburn, Goulding, Josephine, Maymen, Sheetiron, Sites, and Stonyford soils.

Marpa gravelly loam, 30 to 50 percent slopes (MaE).—This soil has moderate permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 2.5 to 6 inches. Fractured shale is at a depth of 20 to 40 inches.

Included with this soil in mapping were areas of Josephine, Maymen, and Sheetiron soils.

This Marpa soil is used as woodland and wildlife habitat and for watershed. Capability unit VIe-1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Marpa gravelly loam, 50 to 75 percent slopes (MaG).—This soil has the profile described as representative for the series. Permeability is moderate. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 2.5 to 6 inches. Fractured shale is at a depth of 20 to 40 inches.

Included with this soil in mapping were small areas of Josephine, Maymen, and Sheetiron soils.

This Marpa soil is used as woodland and wildlife habitat and for watershed. Capability unit VIIe-1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Maymen Series

The Maymen series consists of somewhat excessively drained soils that are underlain by sedimentary or metasedimentary rock. These soils are on uplands in the western part of the survey area near French Gulch, Ono, and Platina. Slopes range from 30 to 80 percent. Elevation ranges from 1,000 to 4,500 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 56° F. The 32° F. growing season is 150 to 200 days, and the 28° F. growing season is 200 to 300 days. The vegetation is shrubs and a sparse cover of annual grasses and forbs.

In a representative profile the surface layer is light-brown, slightly acid very stony loam about 2 inches thick. The subsoil is light-brown, medium acid gravelly loam. Shale is at a depth of about 13 inches.

The areas of Maymen soils are used for watershed and as wildlife habitat.

Representative profile of Maymen very stony loam, 30 to 80 percent slopes, eroded, about 2½ miles northeast of French Gulch along the road to Shirttail Peak in sec. 13, T. 33 N., R. 7 W.:

A1—0 to 2 inches, light-brown (7.5YR 6/4) very stony loam, dark brown (7.5YR 3/3) moist; moderate, medium, granular structure; soft, very friable, nonsticky and nonplastic; very few fine and medium roots; many very fine and common fine pores; slightly acid; clear, smooth boundary.

B21—2 to 7 inches, light-brown (7.5YR 6/4) gravelly loam, reddish brown (5YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots; many very fine interstitial and tubular pores and common fine tubular pores; medium acid; clear, smooth boundary.

B22—7 to 13 inches, light-brown (7.5YR 6/4) gravelly loam, reddish brown (5YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many very fine interstitial and tubular pores and common fine tubular pores; common silt films; medium acid; diffuse, irregular boundary.

R—13 inches, shale; small amount of soil along fracture planes to a depth of about 2 to 4 feet; very few roots below a depth of 18 inches.

The A horizon ranges from 2 to 6 inches in thickness, from brown to light brown in color, from gravelly loam to very stony loam in texture, and from slightly acid to strongly acid in reaction. The B2 horizon ranges from 4 to 14 inches in thickness, from light brown to reddish yellow in color, from loam to gravelly loam in texture, and from slightly acid to strongly acid in reaction. Bedrock of shale, sandstone, conglomerate, or schist is at a depth of 6 to 20 inches.

Maymen soils generally are near areas of Josephine, Marpa, Millsholm, Neuns, Parrish, Sheetiron, and Stonyford soils.

Maymen very stony loam, 30 to 80 percent slopes, eroded (MbG2).—This is the only Maymen soil mapped in the survey area. It has moderate permeability. Runoff is rapid to very rapid, and the hazard of further erosion is high to very high. Available water capacity is 0.75 to 2.5 inches. Bedrock is at a depth of 6 to 20 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were areas of Josephine, Marpa, Millsholm, and Sheetiron soils and areas of Colluvial land.

This Maymen soil is used for watershed and as range and wildlife habitat. Capability unit VIIs-1(15, 17, 18); Very Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 6.

McCarthy Series

The McCarthy series consists of well-drained soils that are underlain by basalt. These soils are on uplands in the eastern part of the survey area near Shingletown, Whitmore, Montgomery Creek, and Big Bend. Slopes range from 0 to 85 percent. Elevation ranges from 2,000 to 5,000 feet. The annual precipitation is 35 to 70 inches, and the average annual air temperature is about 54° F. The 32° F. growing season is 150 to 225 days, and the 28° F. growing season is 200 to 250 days. The vegetation is mixed conifers or brush.

In a representative profile the surface layer is dark-brown, medium acid stony sandy loam and gravelly sandy loam about 20 inches thick. The upper part of the subsoil is strong-brown, slightly acid very cobbly sandy loam about 13 inches thick. The lower part of the subsoil is yellowish-red, slightly acid very cobbly sandy loam. Hard basalt is at a depth of about 44 inches.

The areas of McCarthy soils are used as woodland and wildlife habitat and for watershed.

Representative profile of McCarthy stony sandy loam, 0 to 30 percent slopes, in an area of Cohasset-McCarthy complex, 0 to 30 percent slopes, about 4 miles northeast of Shingletown in the SE¼ sec. 24, T. 31 N., R. 1 E.:

A11—0 to 4 inches, dark-brown (7.5YR 4/4) stony sandy loam, dark brown (7.5YR 3/2) moist; strong, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots and few fine and medium roots; many very fine interstitial pores; medium acid; gradual, smooth boundary.

A12—4 to 20 inches, dark-brown (7.5YR 4/4) gravelly sandy loam, dark reddish brown (5YR 3/3) moist; strong, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots and few fine and medium roots; many very fine interstitial pores; medium acid; diffuse, smooth boundary.

B21—20 to 33 inches, strong-brown (7.5YR 4/6) very cobbly sandy loam, yellowish red (5YR 3/6) moist; strong, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots and few fine and medium roots; many very fine interstitial pores; slightly acid; diffuse, smooth boundary.

B22—33 to 44 inches, yellowish-red (5YR 4/6) very cobbly sandy loam, dark reddish brown (5YR 3/4) moist; strong, very fine, granular structure; soft, very friable, nonsticky and nonplastic; common very fine roots and few fine roots; many very fine interstitial pores; slightly acid; abrupt, irregular boundary.

R—44 inches, hard basalt.

The A horizon ranges from 18 to 20 inches in thickness, from very dark grayish brown to reddish brown in color, from very stony sandy loam to loam in texture, and from slightly acid to medium acid in reaction. The B21 horizon ranges from 10 to 20 inches in thickness, from dark brown to reddish yellow in color, and from slightly acid to medium acid in reaction. The B22 horizon ranges from 12 to 20 inches in thickness, from reddish brown to yellowish red in color, from very cobbly sandy loam to very gravelly loam in texture, and from slightly acid to medium acid in reaction. Basalt is at a depth of 40 to 60 inches.

McCarthy soils generally are near areas of Aiken, Cohasset, Kilare, Sites, and Windy soils. In the survey area McCarthy soils are mapped only in complexes and undifferentiated units with Cohasset and Windy soils.

Millsap Series

The Millsap series consists of well-drained soils that are underlain by sedimentary rock. These soils are on uplands in the western part of the survey area in areas of the Bald Hills south of Ono. Slopes range from 5 to 75 percent. Elevation ranges from 700 to 1,500 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 275 to 325 days. The vegetation is grasses, blue oak, and manzanita.

In a representative profile the surface layer is light brownish-gray and pale-brown, slightly acid loam about 11 inches thick. The subsoil is yellowish-brown, slightly acid silty clay. Sandstone and shale are at a depth of about 33 inches.

The areas of Millsap soils are used mainly as range and wildlife habitat and for watershed. Small areas are used as dryland and irrigated pasture.

Representative profile of Millsap loam, 30 to 50 percent slopes, about 5 miles southwest of Ono in the W½ sec. 33, T. 30 N., R. 7 W.:

A1—0 to 2 inches, light brownish-gray (10YR 6/2) loam, brown (10YR 5/3) moist; moderate, fine and medium, subangular blocky structure and moderate, coarse, platy structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine roots and few fine roots; many very fine interstitial and tubular pores; slightly acid; gradual, wavy boundary.

A3—2 to 11 inches, pale-brown (10YR 6/3) heavy loam, dark brown (10YR 4/3) moist; moderate, coarse, subangular blocky structure; hard, firm, sticky and slightly plastic; common very fine roots and few fine roots; many very fine interstitial and tubular pores; slightly acid; abrupt, wavy boundary.

B2t—11 to 33 inches, yellowish-brown (10YR 5/4) light silty clay, dark yellowish brown (10YR 4/4) moist; massive; very hard, very firm, sticky and very plastic; few very fine roots; many very fine tubular pores; continuous thick clay films in pores and on ped faces; slightly acid; gradual, smooth boundary.

R—33 inches, sandstone and shale.

The A horizon ranges from 10 to 15 inches in thickness, from grayish brown to light brownish gray or light yellowish brown in color, and from slightly acid to medium acid. The B2t horizon ranges from 10 to 25 inches in thickness, from dark brown to yellowish brown in color, from light clay or silty clay to clay in texture, and from slightly acid to medium acid in reaction. Hard sandstone, shale, or conglomerate is at a depth of 20 to 40 inches.

Millsap soils generally are near areas of Gaviota, Lodo, Millsholm, Parrish, Sehorn, and Tehama soils.

Millsap loam, 5 to 30 percent slopes (McD).—This soil has slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 4 to 7 inches. Sandstone and shale are at a depth of 20 to 40 inches.

Included with this soil in mapping were areas of Gaviota and Parrish soils.

This Millsap soil is used mainly as range and dryland pasture, but a few areas are used as irrigated pasture. Capability unit IVe-3(17, 18, 22); Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Millsap loam, 30 to 50 percent slopes (McE).—This soil has the profile described as representative for the series. Permeability is slow. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 4 to 7 inches. Bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping were areas of Gaviota soils.

This Millsap soil is used as range and wildlife habitat and for watershed. Capability unit VIe-1(15, 17, 18); Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Millsap loam, 50 to 75 percent slopes (McG).—This soil has slow permeability. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 4 to 7 inches. Bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping were areas of Gaviota soils.

This Millsap soil is used as range and wildlife habitat and for watershed. Capability unit VIIe-1(15, 18); Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Millsap very rocky loam, 10 to 50 percent slopes (MdE).—This soil has slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 4 to 7 inches. Sandstone and shale are at a depth of 20 to 40 inches. Exposed bedrock outcrops cover 10 to 25 percent of the surface.

Included with this soil in mapping were areas of Gaviota and Millsholm soils.

This Millsap soil is used as range and wildlife habitat and for watershed. Capability unit VIs-1(15, 18); Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Millsholm Series

The Millsholm series consists of well-drained soils that are underlain by sedimentary and metasedimentary rock. These soils are on uplands in the western and north-central parts of the survey area near Platina, Ono, Bella Vista, and Whitmore. Slopes range from 3 to 75 percent. Elevation ranges from 700 to 1,800 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 250 to 340 days. The vegetation is annual grasses and forbs, blue oak, Digger pine, poison oak, and manzanita.

In a representative profile the surface layer is grayish-brown and light brownish-gray, slightly acid gravelly loam about 7 inches thick. The subsoil is brown, medium acid gravelly loam. Sandstone and conglomerate are at a depth of 16 inches.

The areas of Millsholm soils are used as range and wildlife habitat and for watershed.

Representative profile of Millsholm gravelly loam, 30 to 50 percent slopes, about 4½ miles northeast of Platina in the SW¼SW¼ sec. 6, T. 29 N., R. 8 W.:

A1—0 to 2 inches, grayish-brown (10YR 5/2) gravelly light loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky structure; soft, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; slightly acid; clear, smooth boundary.

A3—2 to 7 inches, light brownish-gray (10YR 6/2) gravelly loam, dark brown (10YR 3/3) moist; moderate, fine and medium, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores; slightly acid; clear, wavy boundary.

B2—7 to 16 inches, brown (10YR 6/3) gravelly loam, dark yellowish brown (10YR 3/4) moist; weak, medium, subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; common very fine and fine roots; common fine tubular pores; medium acid; abrupt, irregular boundary.

R—16 inches, sandstone and conglomerate.

The A horizon ranges from 4 to 10 inches in thickness, from grayish brown to pale brown or light brownish gray in color, and from neutral to strongly acid in reaction. The B2 horizon ranges from 4 to 10 inches in thickness, from yellowish brown or brown to light brown in color, and from slightly acid to medium acid in reaction. Hard sandstone, shale, conglomerate, or metasedimentary rock is at a depth of 8 to 20 inches.

Millsholm soils generally are near areas of Gaviota, Josephine, Kilarc, Maymen, Sehorn, and Sites soils.

Millsholm gravelly loam, 3 to 30 percent slopes (MeD).—This soil has moderate permeability. Runoff is medium to rapid, and the hazard of erosion is moderate

to high. Available water capacity is 1.5 to 3 inches. Bedrock is at a depth of 12 to 20 inches.

Included with this soil in mapping were areas of Gaviota and Millsap soils.

This Millsholm soil is used as range. Capability unit VIe-1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Millsholm gravelly loam, 3 to 30 percent slopes, eroded (MeD2).—This soil has moderate permeability. Runoff is medium to rapid, and the hazard of further erosion is moderate to high. Available water capacity is 1 to 2.5 inches. Bedrock is at a depth of 8 to 16 inches.

Included with this soil in mapping were areas of Gaviota and Millsap soils.

This Millsholm soil is used as range and wildlife habitat and for watershed. Capability unit VIe-1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Millsholm gravelly loam, 30 to 50 percent slopes (MeE).—This soil has the profile described as representative for the series. Permeability is moderate. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 1.5 to 3 inches. Bedrock is at a depth of 12 to 20 inches.

Included with this soil in mapping were small areas of Gaviota soils.

This Millsholm soil is used as range and wildlife habitat and for watershed. Capability unit VIIe-1(15, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Millsholm gravelly loam, 50 to 75 percent slopes (MeG).—This soil has moderate permeability. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 1.5 to 3 inches. Sandstone and conglomerate bedrock are at a depth of 12 to 20 inches.

Included with this soil in mapping were areas of Gaviota and Millsap soils.

This Millsholm soil is used as range and wildlife habitat and for watershed. Capability unit VIIe-1(15, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Millsholm very rocky loam, 30 to 50 percent slopes, eroded (MfE2).—This soil has moderate permeability. Runoff is rapid, and the hazard of further erosion is high. Available water capacity is 1 to 2.5 inches. Sandstone and conglomerate bedrock are at a depth of 8 to 16 inches. Exposed bedrock outcrops cover 10 to 25 percent of the surface.

Included with this soil in mapping were small areas of Gaviota and Millsap soils.

This Millsholm soil is used as range and wildlife habitat and for watershed. Capability unit VIIs-1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Millsholm very rocky loam, 50 to 70 percent slopes, eroded (MfF2).—This soil has moderate permeability. Runoff is very rapid, and the hazard of further erosion is very high. Available water capacity is 1 to 2.5 inches. Bedrock is at a depth of 8 to 16 inches. Exposed bedrock outcrops cover 10 to 25 percent of the surface.

Included with this soil in mapping were areas of Gaviota and Millsap soils.

This Millsholm soil is used as range and wildlife habitat and for watershed. Capability unit VIIs-1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Moda Series

The Moda series consists of well-drained and moderately well drained soils that have a hardpan. They formed in gravelly, mixed, old alluvium on terraces or fans in the central part of the survey area near Cottonwood, Olinda, Redding, and Bella Vista. Slopes are 0 to 5 percent. Elevation ranges from 500 to 800 feet. The annual precipitation is 25 to 35 inches, and the average annual air temperature is about 68° F. The 32° F. growing season is 230 to 270 days, and the 28° F. growing season is 310 to 340 days. The vegetation is annual grasses and forbs on the moderately well drained areas and grasses and scattered blue oak, Digger pine, and manzanita on the well-drained areas.

In a representative profile the surface layer is light yellowish-brown and yellowish-brown, medium acid very fine sandy loam and loam about 19 inches thick. The subsoil is yellowish-brown, slightly acid clay. A strongly cemented hardpan is at a depth of about 24 inches.

The areas of Moda soils are used for irrigated crops and as irrigated pasture.

Representative profile of Moda loam, 0 to 3 percent slopes, about 5 miles west of Cottonwood, 1/4 mile southwest of N1/4 corner of sec. 12, T. 29 N., R. 5 W.:

A11—0 to 2 inches, light yellowish-brown (10YR 6/4) very fine sandy loam, dark yellowish-brown (10YR 4/4) moist; weak, thin, platy structure; slightly hard, friable, nonsticky and slightly plastic; many very fine roots; many very fine interstitial and tubular pores and few fine tubular pores; medium acid; clear, smooth boundary.

A12—2 to 19 inches, yellowish-brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, nonsticky and slightly plastic; many very fine roots; many very fine interstitial and tubular pores and few fine tubular pores; medium acid; abrupt, wavy boundary.

B2t—19 to 24 inches, yellowish-brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; strong, medium, columnar structure, thin (1/16–1/4 inch) light brownish-gray coatings on tops of columns; very hard, very firm, very sticky and plastic; common very fine roots; common very fine tubular pores; continuous moderately thick clay films on ped faces and lining tubular pores; slightly acid; abrupt, wavy boundary.

C1m—24 to 39 inches, light yellowish-brown (2.5Y 6/4) strongly cemented iron silica hardpan, dark yellowish brown (10YR 4/4) moist; massive; few very fine roots on surface; moderately thick clay films on fracture planes; moderately alkaline; diffuse, irregular boundary.

IIC2—39 to 60 inches, mixed older stratified alluvium of sand to clay texture.

The A horizon ranges from 6 to 24 inches in thickness, from brown to very pale brown or yellowish brown to light yellowish brown in color, from very fine sandy loam to loam or gravelly loam in texture, and from slightly acid to medium acid in reaction. The B2t horizon ranges from 4 to 12 inches in thickness, from brown to pale brown or yellowish brown in color, and from slightly acid to mildly alkaline in reaction. The Cm horizon is at a depth of 10 to 36 inches and is indurated or strongly cemented. The IIC2 horizon is very cobbly in places.

Moda soils generally are near areas of Churn, Hillgate, Perkins, Red Bluff, Redding, and Tehama soils.

Moda loam, 0 to 3 percent slopes (MgA).—This soil has the profile described as representative for the series. It is well drained and has very slow permeability. Runoff is

very slow, and the hazard of erosion is none to slight. Available water capacity is 3.5 to 6.5 inches. Roots can penetrate to the hardpan that is at a depth of 20 to 36 inches.

Included with this soil in mapping were areas of Churn, Hillgate, and Tehama soils.

This Moda soil is used as irrigated and dryland pasture. Small areas are used for irrigated crops. Capability unit IIIs–3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Moda loam, seeped, 0 to 3 percent slopes (MhA).—This soil is in swales or shallow channels on terraces. It has a profile similar to the one described as representative for the series, except that the surface layer and subsoil are mottled. This soil is moderately well drained and has very slow permeability. Runoff is very slow, and water tends to pond on the surface of this soil and to remain above the hardpan for significant periods after wetting. Available water capacity is 2 to 6.5 inches. Roots can penetrate to the hardpan that is at a depth of 10 to 36 inches.

Included with this soil in mapping were areas in which the hardpan is at a depth of more than 36 inches or in which there is no hardpan. Also included were areas of soils that have a clay loam subsoil and marshy areas.

This Moda soil is used as irrigated and dryland pasture. Because this soil is wetter longer than other Moda soils, the grazing season is generally extended into summer. Capability unit IVw–2(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Moda loam, shallow, 0 to 5 percent slopes (MkB).—This soil is well drained and has very slow permeability. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 2 to 4 inches. Roots can penetrate to the hardpan that is at a depth of 10 to 20 inches.

Included with this soil in mapping were areas of Hillgate, Perkins, and Redding soils and areas of Moda soils that are deeper to the hardpan.

This Moda soil is used mainly as dryland pasture. Small areas are used as irrigated pasture. Capability unit IVs–3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Molinos Series

The Molinos series consists of well-drained and moderately well drained soils that formed in alluvium from basic rock. These soils are on flood plains and alluvial fans in the east-central part of the survey area from the Sacramento River and Cow Creek to Whitmore and Oak Run. Slopes are 0 to 3 percent. Elevation ranges from 600 to 2,000 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 250 to 325 days. The vegetation is valley oak, blue oak, sycamore, Digger pine, wild grapes, and annual grasses and forbs.

In a representative profile the surface layer is grayish-brown, neutral fine sandy loam about 11 inches thick. The substratum is grayish-brown, neutral and mildly alkaline fine sandy loam and silt loam that grades, at a depth of about 51 inches, to gray, mildly alkaline fine sandy loam that has lenses of gravel.

The areas of Molinos soils are used for irrigated and dryland crops.

Representative profile of Molinos fine sandy loam, seeped, about 5½ miles east of Cottonwood, 1,000 feet northeast of the southwest corner of sec. 2, T. 29 N., R. 3 W.:

A1—0 to 11 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, coarse, prismatic structure; slightly hard, very friable, nonsticky and slightly plastic; many very fine roots and few fine and medium roots; many very fine interstitial pores; neutral; gradual, smooth boundary.

C1—11 to 40 inches, grayish-brown (10YR 5/2) fine sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable, nonsticky and slightly plastic; common medium and coarse roots; many very fine interstitial pores and few fine tubular pores; thin intermittent lenses of sand and fine sand throughout the horizon; neutral; gradual, smooth boundary.

C2—40 to 51 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; few, fine, distinct, yellowish-brown (10YR 5/4) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; common medium and coarse roots; many very fine and fine tubular pores; mildly alkaline; gradual, smooth boundary.

C3—51 to 70 inches, gray (10YR 5/1) fine sandy loam, very dark grayish brown (10YR 3/2) moist; few, fine, distinct, yellowish-brown (10YR 5/4) mottles; massive; slightly hard, very friable, nonsticky and slightly plastic; common medium and coarse roots; few lenses and strata of gravel; mildly alkaline.

The A horizon ranges from 10 to 30 inches in thickness, from grayish brown to dark gray in color, from sandy loam to loam in texture, and from slightly acid to neutral in reaction. The C horizon ranges from brown to grayish brown or gray in color, from stratified sandy loam to silt loam in texture, and from slightly acid to mildly alkaline in reaction. Thin lenses of sand or gravel are present throughout the C horizon. Stratified alluvium is at a depth of more than 60 inches.

Molinos soils generally are near areas of Anderson, Inks, Los Robles, Spreckels, Supan, and Vina soils.

Molinos sandy loam, channeled (Mm).—This soil has a profile similar to the one described as representative for the series, except that it has a sandy loam surface layer and is highly stratified. It is channeled by runoff water and is subject to flooding and deposition during wet periods. A few areas are ponded all winter. This soil is moderately well drained. Permeability is moderately rapid. Available water capacity is 7.5 to 9 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of Anderson and Vina soils and of Cobbly alluvial land, frequently flooded, and Riverwash. Also included were areas that have a loam or gravelly sandy loam surface layer.

This Molinos soil is used for irrigated hay and as irrigated and dryland pasture. If this soil is protected from flooding, it is suited to all irrigated crops and to orchards. Capability unit IVw–2(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Molinos fine sandy loam (Mn).—This soil is well drained. Mottles are lacking, but the profile otherwise is similar to that described as representative for the series. Permeability is moderately rapid. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 7.5 to 9 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Anderson and Vina soils and of Cobbly alluvial land, frequently flooded.

This Molinos soil is used mainly for irrigated and dry-

land hay and as irrigated pasture. Small areas are used for other irrigated crops and for orchards. Capability unit I–1(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Molinos fine sandy loam, seeped (Mo).—This soil has the profile described as representative for the series. It is moderately well drained and has moderately rapid permeability. Water ponds on the surface for significant periods after rain or irrigation. Erosion is not a hazard. Available water capacity is 7.5 to 9 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of Anderson and Vina soils and areas of Cobbly alluvial land, frequently flooded, and Riverwash.

This Molinos soil is used mainly for irrigated hay and as irrigated and dryland pasture. Small areas are used for other irrigated crops. Capability unit IIw–2(17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Myers Series

The Myers series consists of well-drained soils that formed in alluvium from sedimentary material. These soils are on intermediate terraces and fans in the east-central part of the survey area along Cow Creek and its tributaries from Millville and Bella Vista east to Whitmore and Oak Run. Slopes are 0 to 8 percent. Elevation ranges from 600 to 2,000 feet. The annual precipitation is 30 to 36 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 250 to 325 days. The vegetation is annual grasses and forbs.

In a representative profile the surface layer, to a depth of about 21 inches, is grayish-brown, slightly acid and neutral silty clay loam and silty clay. Below this layer, to a depth of about 36 inches, it is gray, moderately alkaline silty clay. The substratum is grayish-brown, moderately alkaline silty clay to a depth of about 54 inches. Below, to a depth of more than 60 inches, it is light olive-brown, moderately alkaline gravelly silty clay loam.

The areas of Myers soils are used mainly as dryland and irrigated pasture. A few areas are used for irrigated crops.

Representative profile of Myers silty clay, 3 to 8 percent slopes, on Oak Run Road, 5 miles northeast of Millville, 2,000 feet northwest of the center of sec. 20, T. 32 N., R. 2 W.:

A11—0 to 2 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate, thin and medium, platy structure; very hard, firm, slightly sticky and very plastic; common very fine roots; many very fine tubular pores; slightly acid; abrupt, smooth boundary.

A12—2 to 10 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, prismatic structure; very hard, very firm, slightly sticky and very plastic; common very fine roots; many very fine tubular pores; slightly acid; clear, smooth boundary.

A13—10 to 21 inches, grayish-brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate, coarse, prismatic structure; very hard, very firm, slightly sticky and very plastic; common very fine roots; common very fine tubular pores; common thin clay films or pressure faces on ped faces; neutral; clear, smooth boundary.

A14—21 to 36 inches, gray (5Y 5/1) silty clay, olive (5Y 4/3) moist; moderate, coarse, angular blocky structure; very hard, very firm, slightly sticky and very plastic; few very fine roots; common fine tubular pores; continuous thin clay films or pressure faces on ped faces; common slickensides; moderately alkaline; gradual, smooth boundary.

C1—36 to 54 inches, grayish-brown (2.5Y 5/2) silty clay, grayish brown and dark grayish brown (2.5Y 5/2, 4/2) moist; massive; very hard, firm, sticky and very plastic; many very fine tubular pores and common fine interstitial pores; many thin clay films lining pores; moderately alkaline; few, very small, strongly effervescent rock fragments; gradual, smooth boundary.

C2—54 to 64 inches, light olive-brown (2.5Y 5/3) gravelly silty clay loam, olive brown (2.5Y 4/3) moist; massive; very hard, firm, slightly sticky and plastic; many very fine tubular pores and common fine interstitial pores; common moderately thick clay films lining pores; moderately alkaline; slightly effervescent disseminated lime.

The A horizon ranges from dark grayish brown or grayish brown to dark gray or gray in color, from heavy clay loam to silty clay in texture, and from medium acid to slightly acid in reaction. This horizon ranges from 15 to 38 inches in thickness. The C horizon ranges from dark gray, grayish brown, brown, and light olive brown to olive gray in color, from silty clay or clay to heavy clay loam in texture, and from neutral to moderately alkaline in reaction.

Myers soils generally are near areas of Guenoc, Los Robles, Pentz, Sehorn, Supan, Tuscan, and Vina soils.

Myers silty clay, 0 to 3 percent slopes (MrA).—This soil has slow permeability. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 9 to 11 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of Los Robles and Sehorn soils.

This Myers soil is used mainly as irrigated and dryland pasture and for irrigated hay. Small areas are used for other irrigated crops. Capability unit IIs–5(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 4.

Myers silty clay, 3 to 8 percent slopes (MrB).—This soil has the profile described as representative for the series. Permeability is slow. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 9 to 11 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Los Robles and Sehorn soils.

This Myers soil is used as irrigated and dryland pasture. It is also used for other irrigated crops. Capability unit IIe–5(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 4.

Nanny Series

The Nanny series consists of well-drained soils that formed in gravelly and cobbly glacial outwash alluvium from volcanic rock. These soils are on plateaus and valleys in the eastern part of the survey area near Viola, Latour State Forest, Whitmore, and Montgomery Creek. Slopes are 0 to 8 percent. Elevation ranges from 4,000 to 6,000 feet. The annual precipitation is 45 to 60 inches, and the average annual air temperature is about 44° F. The 32° F. growing season is 90 to 125 days, and the 28° F. growing season is 100 to 150 days. The vegetation is mixed conifers.

In a representative profile the surface layer is very dark grayish-brown, medium acid stony loam about 2 inches

thick. The subsoil is brown, medium acid stony sandy loam and very cobbly sandy loam about 34 inches thick. The substratum is yellowish-brown and light yellowish-brown, very strongly acid very cobbly sandy loam to a depth of more than 60 inches.

The areas of Nanny soils are used as woodland and wildlife habitat and for watershed.

Representative profile of Nanny stony sandy loam, 0 to 8 percent slopes, along State Route 44 south of the campground at Viola in SW¼ sec. 19, T. 31 N., R. 3 E.:

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) stony loam, very dark brown (10YR 2/2) moist; strong, very fine, crumb structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; medium acid; abrupt, smooth boundary.

B1—2 to 20 inches, brown (7.5YR 5/4) stony sandy loam, dark brown (7.5YR 3/4) moist; strong, very fine, crumb structure; soft, very friable, nonsticky and nonplastic; few fine and medium roots and many very fine roots; many very fine interstitial pores; medium acid; diffuse, irregular boundary.

B2—20 to 36 inches, brown (7.5YR 5/5) very cobbly sandy loam, dark reddish brown (5YR 3/4) moist; strong, very fine, crumb structure; soft, very friable, nonsticky and nonplastic; few fine and medium and many very fine roots; many very fine interstitial pores; medium acid; diffuse, irregular boundary.

C1—36 to 60 inches, yellowish-brown (10YR 5/4) very cobbly sandy loam, dark brown (7.5YR 4/4) moist; strong, very fine, granular structure; soft, very friable, nonsticky and nonplastic; few fine and medium roots and many very fine roots; many very fine interstitial pores; very strongly acid; abrupt, irregular boundary.

C2—60 to 66 inches, light yellowish-brown (10YR 6/4) very cobbly sandy loam, mottled, strong brown and dark brown (7.5YR 5/6, 4/4) moist; strong, very fine, granular structure; hard, very firm, nonsticky and nonplastic; few fine and medium roots and many very fine roots; many very fine interstitial pores; horizon appears to be cemented with yellowish colloids in bridges; very strongly acid.

The A horizon ranges from 2 to 12 inches in thickness, from very dark grayish brown to brown in color, from stony coarse sandy loam to stony loam in texture, and from slightly acid to strongly acid in reaction. The B2 horizon ranges 15 to 45 inches in thickness, from brown to very pale brown in color, from very gravelly sandy loam to very cobbly heavy loam in texture, and from medium acid to very strongly acid in reaction. The C horizon is very gravelly or very cobbly sandy loam.

Nanny soils generally are near areas of Aiken, Cohasset, and Windy soils and of the Lyonsville-Jiggs complexes.

Nanny gravelly sandy loam, 0 to 8 percent slopes (NaB).—This soil has a profile similar to the one described as representative for the series, except that the surface layer is gravelly sandy loam. Permeability is rapid. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 4 to 5.5 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of soils that have a consolidated substratum at a depth of 40 to 60 inches and areas of Cohasset and Windy soils. Also included were areas of a brown soil that has a loam surface layer and a clay loam subsoil.

This Nanny soil is used as woodland and wildlife habitat. At lower elevations, if water is available, it is suited to irrigated pasture. Capability unit IIIe–1(22); range site, not assigned; woodland suitability group 1; wildlife group 8.

Nanny stony sandy loam, 0 to 8 percent slopes (NbB).—This soil has the profile described as representative for the series. Permeability is rapid. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 4 to 5.5 inches. Roots can penetrate to a depth of more than 60 inches. Stones and cobblestones cover 0.01 to 3 percent of the surface.

Included with this soil in mapping were areas of soils that have a consolidated substratum at a depth of 40 to 60 inches and areas of Cohasset and Windy soils. Also included were areas of a soil that has a brown loam surface layer and a brown clay loam subsoil and areas that are brown sand underlain by basic igneous rock.

This Nanny soil is used as woodland and wildlife habitat. Capability unit IVe–7(22); range site, not assigned; woodland suitability group 1; wildlife group 8.

Nanny-Windy complex, 0 to 8 percent slopes (NcB).—About 75 percent of this complex is Nanny gravelly sandy loam, 0 to 8 percent slopes, and 25 percent is Windy stony sandy loam, 0 to 8 percent slopes. A few small areas of soils that are similar to Windy soils but that are less than 40 inches deep over bedrock were included in mapping.

The Nanny soil has a profile similar to the one described as repersentative for the Nanny series, except that the surface layer is gravelly sandy loam. Permeability is rapid. Available water capacity is 4 to 5.5 inches. Roots can penetrate to a depth of more than 60 inches.

The Windy soil has a profile similar to that described as representative for the Windy series. It has rapid permeability. Available water capacity is 3.5 to 5.5 inches. Roots can penetrate to a depth of more than 60 inches. Exposed bedrock outcrops associated with the Windy soil cover 10 to 25 percent of the surface.

Runoff is slow on the soils of this unit. The hazard of erosion is slight.

The areas of these soils are used as woodland and wildlife habitat and for watershed. Capability unit IIIe–1(22); range site, not assigned; woodland suitability group 1; wildlife group 8.

Neuns Series

The Neuns series consists of well-drained soils that are underlain by basic metavolcanic rock, mainly greenstone. These soils are on uplands in the western and north-central parts of the survey area near Platina, Ono, French Gulch, Shasta, and Montgomery Creek. Slopes range from 8 to 80 percent. Elevation ranges from 1,000 to 5,000 feet. The annual precipitation is 30 to 60 inches, and the average annual air temperature is about 52° F. The 32° F. growing season is 150 to 200 days, and the 28° F. growing season is 200 to 300 days. The vegetation is mixed conifers, oaks, and shrubs.

In a representative profile the surface layer is pale-brown, medium acid very stony loam about 5 inches thick. The substratum is very pale brown, strongly acid gravelly and very gravelly silty clay loam. Fractured greenstone is at a depth of about 23 inches.

The areas of Neuns soils are used as woodland and wildlife habitat and for watershed.

Representative profile of Neuns very stony loam, 50 to 80 percent slopes, about 10 miles west of Redding and 1

mile west of Whiskeytown Reservoir, in sec. 29, T. 32 N., R. 6 W.:

O1—½ inch to 0, black oak, canyon oak, and yellow pine litter.
A1—0 to 5 inches, pale-brown (10YR 6/3) very stony loam, brown (10YR 5/3) moist; massive; soft, friable, slightly sticky and plastic; many very fine roots and few fine and medium roots; many very fine and few fine tubular and interstitial pores; medium acid; gradual, smooth boundary.
C1—5 to 13 inches, very pale brown (10YR 7/4) gravelly light silty clay loam, yellowish brown (10YR 5/5) moist; moderate, medium, subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots, common fine and medium roots, and few coarse roots; many very fine and common fine tubular and interstitial pores; strongly acid; gradual, smooth boundary.
C2—13 to 23 inches, very pale brown (10YR 7/3) very gravelly silty clay loam, yellowish brown (10YR 5/4) moist; moderate, medium, subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine and fine roots and few medium roots; many very fine and few fine tubular and interstitial pores; many moderately thick clay films in pores and as bridges; strongly acid; abrupt, irregular boundary.
R—23 inches, fractured weathered greenstone; continuous moderately thick clay films on fracture planes; very strongly acid.

The A horizon ranges from 5 to 8 inches in thickness, from brown to pale yellow in color, and from very stony loam to very stony light silty clay loam in texture. The C horizon ranges from 15 to 34 inches in thickness, from very gravelly heavy sandy loam to very gravelly silty clay loam in texture, and from medium acid to strongly acid in reaction. Fractured, weathered basic metavolcanic rock is at a depth of 20 to 40 inches.

Neuns soils generally are near areas of Auburn, Boomer, Chaix, Goulding, Sheetiron, and Stonyford soils and of Landslides.

Neuns very stony loam, 8 to 50 percent slopes (NdE).—This soil has moderate permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 2 to 4.5 inches. Bedrock is at a depth of 20 to 40 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Boomer and Goulding soils and of Landslides.

This Neuns soil is used as woodland and wildlife habitat and for watershed. Capability unit VIs–1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Neuns very stony loam, 50 to 80 percent slopes (NdG).—This soil has the profile described as representative for the series. Permeability is moderate. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 2 to 4.5 inches. Roots can penetrate to a depth of 20 to 40 inches. Stones and cobblestones cover 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Boomer and Goulding soils and areas of Landslides.

This Neuns soil is used as woodland and wildlife habitat and for watershed. Capability unit VIIs–1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Newtown Series

The Newtown series consists of well-drained soils that formed in old alluvium from mixed sources. They are on high terraces in the central part of the survey area from Cottonwood and Gas Point to Redding and Bella Vista. Slopes range from 8 to 50 percent. Elevation ranges from 500 to 1,000 feet. The annual precipitation is 28 to 40 inches, and the average annual air temperature is about 63°F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 250 to 325 days. The vegetation is grasses, forbs, oaks, shrubs, and Digger pine.

In a representative profile the surface layer is brown, slightly acid gravelly loam and mixed very pale brown and brown, slightly acid very gravelly clay loam about 18 inches thick. The subsoil is brown, strongly acid clay and pale-brown, slightly acid silty clay loam. At a depth of about 65 inches, the substratum is pale-brown, neutral cobbly silty clay loam.

The areas of Newtown soils are used as range, dryland pasture, and wildlife habitat and for watershed.

Representative profile of Newtown gravelly loam, 30 to 50 percent slopes, eroded, about 2½ miles south of Olinda, 1,300 feet north-northwest of the southeast corner of sec. 34, T. 30 N., R. 5 W.:

A1—0 to 8 inches, brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine tubular and interstitial pores and few fine tubular pores; slightly acid; clear, smooth boundary.
A3—8 to 18 inches, mixed, very pale brown (10YR 7/4) and brown (7.5YR 5/4) very gravelly clay loam, dark brown (7.5YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots and many medium roots; many very fine tubular pores; slightly acid; clear, smooth boundary.
B2t—18 to 35 inches, brown (7.5YR 5/4) light clay, dark brown (7.5YR 4/4) moist; common, medium, distinct, yellowish-red mottles; moderate, medium, angular blocky structure; very hard, firm, sticky and very plastic; few fine and many medium roots; common very fine tubular pores; continuous moderately thick clay films on ped faces and in pores; manganese stains in pores and on ped faces; strongly acid; gradual, smooth boundary.
B3t—35 to 65 inches, pale-brown (10YR 6/3) silty clay loam, dark yellowish brown (10YR 4/4) moist; common, medium, distinct, dark-brown mottles; weak, coarse, angular blocky structure; very hard, firm, sticky and plastic; common medium roots; few very fine tubular pores; continuous moderately thick clay films on ped faces; manganese stains in pores and on ped faces; slightly acid; gradual, smooth boundary.
C—65 to 72 inches, pale-brown (10YR 6/3) cobbly light silty clay loam, strong brown (7.5YR 5/6) moist; common, medium, reddish-brown mottles; massive; very hard, friable, slightly sticky and plastic; common medium roots; many very fine tubular pores; few thin clay films in pores; neutral.

The A horizon ranges from 10 to 18 inches in thickness, from brown to light yellowish brown or very pale brown in color, from gravelly or stony loam to very gravelly clay loam in texture, and from slightly acid to strongly acid in reaction. The B2t horizon ranges from 12 to 30 inches in thickness, from brown to light brown to reddish yellow in color, from heavy clay loam or silty clay to light clay in texture, and from slightly acid to strongly acid in reaction. The C horizon ranges from light yellowish brown to pale brown in color, from gravelly clay loam to cobbly silty clay loam in texture, and from neutral to medium acid in reaction. In some places the C horizon contains clay lenses, gravelly or cobbly sand strata, and cemented layers. In a few places consolidated tuffaceous sediments outcrop.

Newtown soils generally are near areas of Churn, Igo, Perkins, Red Bluff, and Redding soils.

Newtown gravelly loam, 8 to 15 percent slopes (NeC).—This soil has slow permeability. Runoff is medium, and the hazard of erosion is moderate. Available water capacity is 9 to 11 inches. The soil is more than 60 inches deep. The content of gravel is 15 to 30 percent in the surface layer.

Included with this soil in mapping were small areas of Perkins and Red Bluff soils. Also included were areas of soils that have a weakly cemented substratum at a depth of 36 to 60 inches.

This Newtown soil is used as range and dryland pasture. Capability unit IIIc–3(17, 22); Upland Terrace range site; woodland suitability group, not assigned; wildlife group 5.

Newtown gravelly loam, 15 to 30 percent slopes (NeD).—This soil has slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 9 to 11 inches. This soil is more than 60 inches deep. The content of gravel is 15 to 30 percent in the surface layer.

Included with this soil in mapping were areas of soils that have a weakly cemented substratum at a depth of 36 to 60 inches. Also included were areas of Perkins and Red Bluff soils.

This Newtown soil is used as range and dryland pasture. Capability unit IVe–3(17, 18, 22); Upland Terrace range site; woodland suitability group, not assigned; wildlife group 5.

Newtown gravelly loam, 30 to 50 percent slopes, eroded (NeE2).—This soil has the profile described as representative for the series. Permeability is slow. Runoff is rapid, and the hazard of further erosion is high. Available water capacity is 9 to 11 inches. The soil is more than 60 inches deep. The content of gravel is 15 to 30 percent in the surface layer.

Included with this soil in mapping were areas of soils that have a cemented substratum at a depth of 36 to 60 inches and areas of Perkins and Red Bluff soils. Also included were some areas of stony soils.

This Newtown soil is used as range and wildlife habitat and for watershed. Capability unit VIe–1(15, 17, 18); Upland Terrace range site; woodland suitability group, not assigned; wildlife group 5.

Newtown stony loam, 8 to 50 percent slopes, eroded (NfE2).—This soil has slow permeability. Runoff is medium to rapid, and the hazard of further erosion is moderate to high. Available water capacity is 9 to 11 inches. The soil is more than 60 inches deep. Stones cover 1 to 3 percent of the surface, and the content of gravel is 15 to 30 percent in the surface layer.

Included with this soil in mapping were areas of soils that have a weakly cemented substratum at a depth of 36 to 60 inches. Also included around Gas Point are areas of a Newtown soil that has a sandy loam surface layer and, near Cow Creek, areas of a Newtown soil that has a stony sandy loam surface layer.

This Newtown soil is used as range and wildlife habitat and for watershed. Capability unit VIe–1(15, 17, 18); Upland Terrace range site; woodland suitability group, not assigned; wildlife group 5.

Parrish Series

The Parrish series consists of well-drained soils that are underlain by schist, metasedimentary rock, or sedimentary rock. They are on uplands in the western and northeastern parts of the survey area near Platina, Ono, French Gulch, and Montgomery Creek. Slopes range from 8 to 70 percent. Elevation ranges from 1,000 to 3,000 feet. The annual precipitation is 30 to 60 inches, and the average annual air temperature is about 52° F. The 32° F. growing season is 150 to 200 days, and the 28° F. growing season is 200 to 300 days. The vegetation is shrubs, oaks, Digger pine, annual and perennial grasses, and forbs.

In a representative profile the surface layer is brown and reddish-brown, slightly acid and medium acid loam about 9 inches thick. The subsoil is reddish-brown and yellowish-red, medium acid gravelly heavy clay loam and reddish-yellow, slightly acid gravelly heavy loam. Decomposing schistose meta-andesite bedrock is at a depth of 38 inches.

The areas of Parrish soils are used as dryland pasture, range, and wildlife habitat and for watershed.

Representative profile of Parrish loam, 30 to 50 percent slopes, about 3½ miles west of Ono at the center of NW¼ sec. 8, T. 30 N., R. 7 W.:

A1—0 to 3 inches, brown (7.5YR 5/3) light loam, dark brown (7.5YR 3/3) moist; massive; hard, friable, nonsticky and slightly plastic; many very fine roots; many very fine interstitial and tubular pores; slightly acid; clear, smooth boundary.

A3—3 to 9 inches, reddish-brown (5YR 5/4) loam, reddish brown (5YR 4/3) moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine interstitial and tubular pores and few fine tubular pores; medium acid; abrupt, slightly wavy boundary.

B21t—9 to 20 inches, reddish-brown (2.5YR 4/4) gravelly heavy clay loam, red (2.5YR 4/6) with reddish-brown coatings moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; common very fine and few fine roots; many very fine tubular pores and few very fine interstitial pores; common thin clay films on ped faces and many thin clay films in pores; medium acid; diffuse, wavy boundary.

B22t—20 to 30 inches, yellowish-red (5YR 5/6) gravelly heavy clay loam that has reddish-brown coatings on peds, red (2.5YR 4/6) with reddish-brown coatings moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; common very fine roots and few fine roots; many very fine tubular pores and few very fine interstitial pores; common moderately thick clay films on ped faces; medium acid; gradual, smooth boundary.

B3t—30 to 38 inches, reddish-yellow (7.5YR 6/6) gravelly heavy loam, yellowish red (5YR 4/6) moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; many very fine interstitial and tubular pores; common moderately thick clay films in pores; slightly acid; slightly irregular boundary.

R—38 inches, yellowish-brown (10YR 5/4) decomposing, but hard, schistose meta-andesite; common clay films along fracture planes in upper part; slightly acid

The A horizon ranges from 2 to 15 inches in thickness, from reddish brown to yellowish brown or brown in color, from loam to gravelly loam in texture, and from slightly acid to medium acid in reaction. The B2t horizon ranges from 15 to 30 inches in thickness, from reddish brown to yellowish red or reddish yellow in color, from gravelly clay loam to gravelly light clay in texture, and from slightly acid to strongly acid in reaction. Hard fractured bedrock is at a depth of 20 to 40 inches.

Parrish soils generally are near areas of Auburn, Boomer, Goulding, Kilare, Millsholm, and Stonyford soils.

Parrish loam, 8 to 30 percent slopes (PcD). -This soil has slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 3 to 7 inches. Bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping were areas of Auburn, Gaviota, Millsholm, and Stonyford soils.

This Parrish soil is used as range, dryland pasture, and wildlife habitat and for watershed. Capability unit IVe-8(17, 18); Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Parrish loam, 30 to 50 percent slopes (PcE).—This soil has the profile described as representative for the series. Permeability is slow. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 3 to 7 inches. Bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping were small areas of Auburn, Gaviota, Millsholm, and Stonyford soils.

This Parrish soil is used as range and wildlife habitat and for watershed. Capability unit VIe-1(15, 17, 18); Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Parrish loam, 50 to 70 percent slopes (PcF).—This soil has slow permeability. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 3 to 7 inches. Bedrock is at a depth of 20 to 40 inches.

Included with this soil in mapping were areas of Auburn, Gaviota, Millsholm, and Stonyford soils.

This Parrish soil is used mainly as range and wildlife habitat and for watershed. Capability unit VIIe-1(15, 18); Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Pentz Series

The Pentz series consists of somewhat excessively drained soils that are underlain by volcanic tuff or tuffaceous sediment. These soils are on uplands in the southeastern part of the survey area near Black Butte and Whitmore. Slopes range from 5 to 70 percent. Elevation ranges from 600 to 1,800 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 225 days, and the 28° F. growing season is 315 to 335 days. The vegetation is blue oak, interior live oak, manzanita, ceanothus, yerba santa, annual grasses, and Digger pine.

In a representative profile the surface layer is grayish-brown, neutral and slightly acid sandy loam and fine sandy loam about 5 inches thick. The substratum is light-gray, slightly acid fine sandy loam and light-gray, medium acid very gravelly sandy loam. Strongly cemented white tuff is at a depth of about 18 inches.

The areas of Pentz soils are used as range and wildlife habitat and for watershed.

Representative profile of Pentz sandy loam, 50 to 70 percent slopes, from an area of Pentz-Supan complex, 50 to 70 percent slopes, about 3 miles north of Millville, 1/4 mile east of the southwest corner of sec. 26, T. 32 N., R. 3 W.:

A11—0 to 2 inches, grayish-brown (10YR 5/2) sandy loam, very dark brown (10YR 2/2) moist; moderate, fine, granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial and tubular pores; few fine concretions, 1 to 2 millimeters in diameter; neutral; abrupt, smooth boundary.

A12—2 to 5 inches, grayish-brown (10YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; slightly hard, very friable, nonsticky and slightly plastic; many fine and medium roots; common very fine interstitial and tubular pores; common concretions; slightly acid; abrupt, smooth boundary.

C1—5 to 11 inches, light-gray (10YR 7/1) fine sandy loam, light brownish gray (2.5Y 6/2) moist; few, medium, faint, light-gray mottles and few, medium, distinct, grayish-brown mottles; massive; hard, very friable, nonsticky and nonplastic; few fine roots, many medium roots, and common coarse roots; many very fine interstitial pores and few fine and medium tubular pores; slightly micaceous; slightly acid; clear, smooth boundary.

C2—11 to 18 inches, light-gray (10YR 7/1) very gravelly sandy loam, grayish brown (2.5Y 5/2) moist; few, medium, distinct, very pale brown (10YR 7/4) and white (2.5Y 8/2) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; many medium and coarse roots; many fine pores; slightly micaceous; medium acid; gradual, smooth boundary.

R—18 inches, white (2.5Y 8/2) tuff; massive; strongly cemented, nonsticky and nonplastic; few very fine and fine roots; many dark-brown (7.5YR 3/4) stains along fracture planes; few very fine tubular pores; micaceous; medium acid.

The A horizon ranges from 2 to 9 inches in thickness, from light grayish brown to brown in color, from sandy loam to loam in texture, and from neutral to medium acid in reaction. The C horizon ranges from 4 to 14 inches in thickness, from light gray to pale yellow or pale brown in color, and from sandy loam to loam in texture. In places the lower part of the C horizon is gravelly or very gravelly. Consolidated tuffaceous sediment is at a depth of 6 to 20 inches. These soils are very stony or very rocky.

Pentz soils generally are near areas of Inks, Newtown, Supan, Toomes, and Tuscan soils. Pentz soils, in this survey area, are mapped only in complexes with Inks and Supan soils.

Pentz-Supan complex, 50 to 70 percent slopes (PfF).—About 50 percent of this complex is Pentz sandy loam, 50 to 70 percent slopes, and 35 percent is Supan very stony loam, 50 to 70 percent slopes. The remaining 15 percent consists of inclusions of Inks and Tuscan soils.

The Pentz soil has the profile described as representative for the series. Permeability is moderately rapid. Available water capacity is 1 to 2.5 inches. Tuff is at a depth of 6 to 20 inches. Exposed tuffaceous bedrock outcrops cover 5 to 30 percent of the surface.

The Supan soil has a profile similar to the one described as representative for the series. Permeability is moderately slow. Available water capacity is 4 to 7 inches. Tuff breccia is at a depth of 24 to 40 inches. Stones cover 3 to 15 percent of the surface.

Runoff is very rapid on the soils of this unit. The hazard of erosion is very high.

The areas of these soils are used as range and wildlife habitat and for watershed. Capability unit VIIs-1 (15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Perkins Series

The Perkins series consists of well-drained and moderately well drained soils that formed in mixed alluvium. They are on intermediate terraces in the central part of the survey area from Cottonwood Creek north to Redding. Slopes range from 0 to 30 percent. Elevation ranges from

600 to 800 feet. The annual precipitation is 25 to 35 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 250 to 325 days. The vegetation is blue oak, valley oak, interior live oak, poison oak, manzanita, Digger pine, and annual grasses and forbs.

In a representative profile the surface layer is brown, slightly acid gravelly loam about 10 inches thick. The subsoil is yellowish-red and reddish-brown, slightly acid gravelly clay loam about 44 inches thick. The substratum is slightly acid, yellowish-red gravelly clay loam that extends to a depth of more than 60 inches.

The areas of Perkins soils are used for hay and irrigated crops and as pasture. Small areas are also used as sites for homes and for other related nonfarm uses.

Representative profile of Perkins gravelly loam, 0 to 3 percent slopes, about 4½ miles west of Cottonwood and 500 feet east of the northwest corner of sec. 7, T. 29 N., R. 4 W.:

AP—0 to 6 inches, brown (7.5YR 5/4) gravelly loam, dark reddish brown (5YR 3/3) moist; weak, medium, platy structure; slightly hard, friable, nonsticky and slightly plastic; few fine roots; many very fine interstitial pores; slightly acid; clear, smooth boundary.

A3—6 to 10 inches, brown (7.5YR 5/4) gravelly heavy loam, dark reddish brown (5YR 3/3) moist; common, medium, yellowish-red mottles; massive; hard, friable, nonsticky and slightly plastic; few fine roots; many very fine interstitial pores; slightly acid; abrupt, wavy boundary.

B11—10 to 18 inches, yellowish-red (5YR 5/6) gravelly light clay loam, dark red (2.5YR 3/6) moist; common, medium, prominent, black mottles and common, black mottles moist; massive; hard, firm, brittle, slightly sticky and slightly plastic; few fine roots; many very fine tubular pores; common moderately thick clay films in pores; slightly acid; abrupt, irregular boundary.

B12t—18 to 32 inches, mixed yellowish-red (5YR 5/6) and reddish-brown (5YR 4/4) gravelly light clay loam, mixed dark reddish brown (2.5YR 3/4) and dark red (2.5YR 3/6) moist; few, fine, black mottles; massive; hard, friable, slightly sticky and slightly plastic; very few fine roots; many very fine interstitial pores and common very fine tubular pores; common moderately thick clay films in pores; slightly acid, abrupt, wavy boundary.

B21t—32 to 41 inches, yellowish-red (5YR 5/6) gravelly clay loam that has red clay films, reddish brown (2.5YR 4/4) moist; massive; very hard, firm, slightly sticky and plastic; very few fine roots; many very fine interstitial pores and common very fine tubular pores; many moderately thick clay films in pores; slightly acid; gradual, smooth boundary.

B22t—41 to 54 inches, yellowish-red (5YR 5/6) gravelly clay loam that has red clay films, dark red (2.5YR 3/6) moist; massive; very hard, firm, sticky and plastic; very few fine roots; common fine tubular pores and many very fine interstitial pores; many moderately thick clay films in pores; slightly acid; clear, smooth boundary.

C—54 to 60 inches, yellowish-red (5YR 4/8) gravelly clay loam, dark reddish brown (2.5YR 3/4) moist; few, medium, prominent, reddish-yellow mottles moist; massive; very hard, firm, sticky and plastic; very few fine roots; common thin clay films in pores; slightly acid.

The A horizon ranges from 8 to 12 inches in thickness, from reddish brown to light yellowish brown in color, from gravelly loam to loam in texture, and from slightly acid to medium acid in reaction. The B2t horizon ranges from 20 to 45 inches or more in thickness, from yellowish red to reddish brown in color, from gravelly clay loam to clay loam in texture, and from slightly acid to medium acid in reaction. In a few places the C horizon is at a depth of 24 to 36 inches and is weakly consolidated (fig. 2), which is shallower than that of Perkins soils recognized elsewhere in California.

Perkins soils generally are near areas of Churn, Moda, Newtown, Red Bluff, Reiff, and Tehama soils.

Figure 2.—Profile of a Perkins gravelly loam that has a substratum of weakly consolidated sediment from the Tehama formation.

Perkins loam, 0 to 3 percent slopes (PlA).—This soil has a profile similar to the one described as representative for the series, except that the content of gravel is 0 to 10 percent throughout the profile. The soil is well drained and has slow permeability. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 6.5 to 8.5 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Red Bluff soils and Perkins gravelly loam.

This Perkins soil is used for irrigated and dryland hay and as irrigated pasture. Small areas are used for other irrigated crops. Capability unit IIs-3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Perkins gravelly loam, 0 to 3 percent slopes (PmA).—This soil has the profile described as representative for the series. It is well drained and has slow permeability. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 5 to 7 inches. Roots can penetrate to a depth of more than 60 inches. The content of gravel is 10 to 30 percent throughout the profile.

Included with this soil in mapping were small areas of Churn, Moda, Red Bluff, and Redding soils.

This Perkins soil is used for irrigated hay and as irrigated and dryland pasture (fig. 3). Small areas are used for other irrigated crops. Capability unit IIs-3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

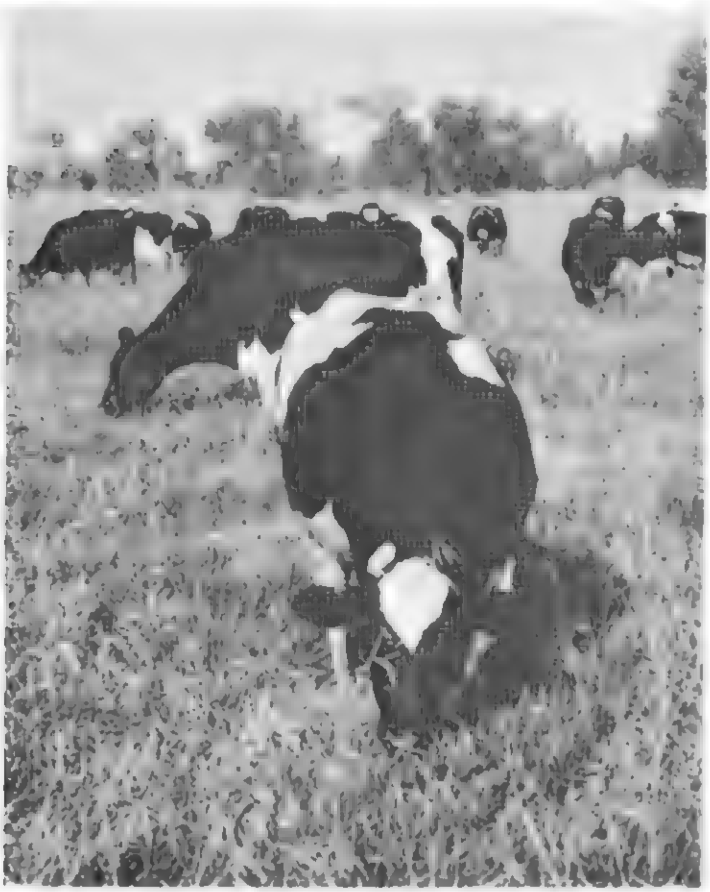

Figure 3.—Cattle grazing irrigated pasture on Perkins gravelly loam, 0 to 3 percent slopes.

Perkins gravelly loam, 3 to 8 percent slopes (PmB).—This soil is well drained and has slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 5 to 7 inches. Roots can penetrate to a depth of more than 60 inches. The content of gravel is 10 to 30 percent throughout the profile.

Included with this soil in mapping were small areas of Red Bluff and Redding soils.

This Perkins soil is used as irrigated and dryland pasture. Small areas are used for other irrigated crops. Capability unit IIe-3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Perkins gravelly loam, 8 to 15 percent slopes (PmC).—This soil is well drained and has slow permeability. Runoff is medium, and the hazard of erosion is moderate. Available water capacity is 5 to 7 inches. Roots can penetrate to a depth of more than 60 inches. The content of gravel is 10 to 30 percent throughout the profile.

Included with this soil in mapping were small areas of Newtown, Red Bluff, and Redding soils.

This Perkins soil is used for dryland pasture and for urban uses near Redding. Capability unit IIIe-3(17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Perkins gravelly loam, 15 to 30 percent slopes (PmD).—This soil is well drained and has slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 5 to 7 inches. Roots can penetrate to a depth of more than 60 inches. The content of gravel is 15 to 35 percent throughout the profile.

Included with this soil in mapping were small areas of Newtown, Red Bluff, and Redding soils.

This Perkins soil is used as dryland pasture. A few areas of this soil have a dense stand of blue oak, interior live oak, poison oak, and manzanita and only a sparse cover of grasses. Capability unit IVe-3(17, 18, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Perkins gravelly loam, seeped, 0 to 3 percent slopes (PnA).—This soil is wet and generally has a water table at a depth of 3 to more than 5 feet after rain or excess irrigation. This soil is moderately well drained. Permeability is slow. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 5 to 7 inches. Roots can penetrate to a depth of more than 60 inches. The content of gravel is 10 to 30 percent throughout the profile.

Included with this soil in mapping were small areas of Newtown, Red Bluff, and Redding soils.

This Perkins soil is used as irrigated and dryland pasture. Capability unit IIw-2(17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Perkins gravelly loam, moderately deep, 0 to 3 percent slopes (PoA).—This soil has a profile similar to the one described as representative for the series, except that it is 24 to 36 inches deep over a weakly consolidated substratum that restricts penetration of plant roots. The soil is moderately well drained and has very slow permeability. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 3 to 5 inches. The content of gravel is 15 to 35 percent throughout the profile.

Included with this soil in mapping were areas of Moda, Red Bluff, and Redding soils.

This Perkins soil is used as irrigated and dryland pasture. Capability unit IIIs-3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Perkins gravelly loam, moderately deep, 3 to 8 percent slopes (PoB).—This soil has a profile similar to the one described as representative for the series, except that it is 24 to 36 inches deep over a weakly consolidated substratum that restricts penetration of plant roots. The soil is moderately well drained and has very slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 3 to 5 inches. The content of gravel is 15 to 35 percent throughout the profile.

Included with this soil in mapping were areas of Moda, Red Bluff, and Redding soils.

This Perkins soil is used as irrigated and dryland pasture. Capability unit IIIe-3 (17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Red Bluff Series

The Red Bluff series consists of well drained and moderately well drained soils that formed in gravelly old alluvium from mixed sources. They are on undulating high terraces in the central part of the survey area near Olinda, Redding, and Stillwater Plains. Slopes are 0 to 8 percent. Elevation ranges from 600 to 900 feet. The annual precipitation is 25 to 35 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 250 to 325 days. The vegetation is blue oak, interior live oak, manzanita, Digger pine, and annual grasses and forbs.

In a representative profile the surface layer is brown, very strongly acid loam about 6 inches thick. The upper 22 inches of the subsoil is yellowish-red, very strongly acid and strongly acid clay loam. The lower 29 inches of the subsoil is red, strongly acid heavy clay loam and light clay. A light-brown, medium acid clay loam subtstratum that extends to a depth of more than 60 inches is at a depth of about 57 inches.

The areas of Red Bluff soils are used as range and pasture and for olive orchards and homesites.

Representative profile of Red Bluff loam, 0 to 3 percent slopes, at Service Center, U.S. Forest Service, about 5 miles north of Anderson, 1,000 feet east and 100 feet south of N¼ corner of sec. 27, T. 31 N., R. 4 W.:

A1—0 to 6 inches, brown (7.5YR 5/4) heavy loam, dark reddish brown (5YR 3/4) moist; moderate, fine, granular structure; slightly hard, very friable, nonsticky and slightly plastic; few very fine roots; many very fine interstitial pores; common concretions, 1 to 8 millimeters in diameter; very strongly acid; clear, smooth boundary.

B11—6 to 18 inches, yellowish-red (5YR 4/6) light clay loam that has many fine manganese stains, yellowish red (5YR 3/6) moist; strong, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine interstitial pores; few thin clay films as bridges; many concretions, 1 to 4 millimeters in diameter; very strongly acid; clear, irregular boundary.

B12—18 to 28 inches, yellowish-red (5YR 4/6) clay loam, yellowish red (5YR 3/6) moist; many, fine, prominent mottles of manganese moist; strong, fine, granular structure; slightly hard, firm, irregularly shaped masses high in manganese that are friable when crushed, slightly sticky and slightly plastic; few very fine, fine, and medium roots; many very fine interstitial pores and common fine tubular pores; common thin clay films as bridges; many concretions, 1 to 4 millimeters in diameter; strongly acid; clear, irregular boundary.

B21t—28 to 44 inches, red (2.5YR 4/6) heavy clay loam, dark reddish brown (2.5YR 3/4) moist, and common, fine, prominent, manganese stains moist; moderate, medium, subangular blocky structure; very hard, firm, slightly sticky and plastic; few fine roots; many very fine and common fine tubular pores; many moderately thick clay films in pores and on ped faces; few concretions, 1 to 4 millimeters in diameter; strongly acid; gradual, smooth boundary.

B22t—44 to 57 inches, red (2.5YR 4/6) light clay, dark red (2.5YR 3/6) moist; few, medium, prominent, black mottles moist; moderate, medium, subangular blocky structure; very hard, firm, slightly sticky and plastic; few fine roots; many very fine and common fine tubular pores; many moderately thick clay films in pores and on ped faces; strongly acid; gradual, smooth boundary.

C—57 to 67 inches, light-brown (7.5YR 6/4) clay loam, strong brown (7.5YR 5/6) moist; common, fine, pink and yellowish-red mottles, few fine manganese stains, and few, fine, prominent, yellowish-red mottles moist; moderate, medium, subangular blocky structure; very hard, firm, slightly sticky and plastic; few fine roots; many very fine and common fine tubular pores; few moderately thick clay films in pores and on ped faces; medium acid.

The A horizon ranges from 6 to 15 inches in thickness, from brown to yellowish red in color, from loam to gravelly loam in texture, and from medium acid to very strongly acid in reaction. The B2t horizon ranges from 18 to 45 inches in thickness, from red to yellowish red in color, from heavy clay loam to clay in texture, and from strongly acid to very strongly acid in reaction. The C horizon is gravelly clay loam to clay loam. In about half of the areas of this soil the surface layer is only slightly gravelly. In areas where the surface layer is gravelly, the C horizon generally is at a depth of 24 to 36 inches and is silica-indurated. The C horizon in these areas is shallower than that of Red Bluff soils recognized elsewhere in California.

Red Bluff soils generally are near areas of Clough, Moda, Newtown, Perkins, and Redding soils.

Red Bluff loam, 0 to 3 percent slopes (RbA).—This soil has the profile described as representative for the series. It is well drained and has moderately slow permeability. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 8 to 10 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Moda, Newtown, Perkins, and Redding soils.

This Red Bluff soil is used as range and dryland pasture and for orchards and specialty crops (fig. 4). Some areas are also used for homesites and related uses. Capability unit IIIs-9(17); Acid Terrace range site; woodland suitability group, not assigned; wildlife group 5.

Red Bluff loam, 3 to 8 percent slopes (RbB).—This soil is well drained and has moderately slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 8 to 10 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Newtown, Perkins, and Redding soils.

This Red Bluff soil is used as range and dryland pasture and for a few olive orchards. Capability unit IIIe-9

Figure 4.—Olive orchard on Red Bluff loam, 0 to 3 percent slopes, near Olinda.

(17); Acid Terrace range site; woodland suitability group, not assigned; wildlife group 5.

Red Bluff gravelly loam, moderately deep, 0 to 3 percent slopes (RcA).—This soil has a profile similar to the one described as representative for the series, except that it is 24 to 36 inches deep over a silica-indurated gravelly or cobbly substratum. The soil is moderately well drained and has very slow permeability. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 3.5 to 5.5 inches. The content of gravel is 15 to 35 percent throughout the profile.

Included with this soil in mapping were small areas of Newtown, Perkins, and Redding soils.

This Red Bluff soil is used as range and dryland pasture and for a few olive orchards. Capability unit IIIs-9(17); Acid Terrace range site; woodland suitability group, not assigned; wildlife group 5.

Red Bluff gravelly loam, moderately deep, 3 to 8 percent slopes (RcB).—The profile of this soil is similar to the one described as representative for the series, except that it is 24 to 36 inches deep over a silica-indurated gravelly or cobbly substratum. The soil is moderately well drained and has very slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 3.5 to 5.5 inches. The content of gravel is 15 to 35 percent throughout the profile.

Included with this soil in mapping were small areas of Newtown, Perkins, and Redding soils.

This Red Bluff soil is used as range and dryland pasture. Small areas are used for olive orchards. Capability unit IIIe-9(17); Acid Terrace range site; woodland suitability group, not assigned; wildlife group 5.

Redding Series

The Redding series consists of well-drained soils that contain an indurated hardpan (fig. 5). They are underlain by old mixed alluvium. The soils are nearly level to undulating on hummocky high terraces in the central part of the survey area near Cottonwood, Olinda, Redding, and Bella Vista. Slopes are 0 to 8 percent. Elevation ranges from 450 to 900 feet. The annual precipitation is 25 to 35 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 225 to 275 days, and the 28° F. growing season is 310 to 335 days. The vegetation is annual grasses, forbs, manzanita, and blue oak.

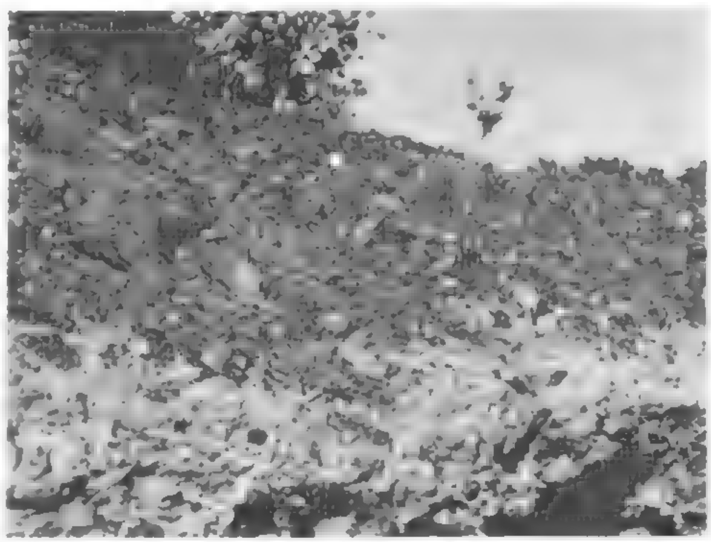

Figure 5.—Hardpan in a Redding gravelly loam.

In a representative profile the surface layer is strong-brown, strongly acid gravelly loam about 5 inches thick. The subsoil is mixed, reddish-brown and red, strongly acid clay that extends to a depth of about 13 inches. Below this layer is an indurated very gravelly hardpan

about 15 inches thick. Stratified mixed alluvial material is below the hardpan.

The areas of Redding soils are used as range and pasture.

Representative profile of Redding gravelly loam, 0 to 3 percent slopes, about 3 miles southeast of Anderson, 600 feet east-northeast of W1/4 corner of sec. 31, T. 30 N., R. 3 W.:

A11—0 to 5 inches, strong-brown (7.5YR 5/6) gravelly loam, yellowish red (5YR 3/6) moist; massive; slightly hard, friable, nonsticky and slightly plastic; many very fine roots; many very fine interstitial and tubular pores; strongly acid; abrupt, smooth boundary.

A12—5 to 6 inches, mixed, brown and light-brown (7.5YR 5/4, 6/4) heavy loam, yellowish red (5YR 3/6) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial and tubular pores; strongly acid; abrupt, wavy boundary.

B2t—6 to 13 inches, mixed, reddish-brown (5YR 5/4) and red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, medium, angular blocky structure; very hard, firm, sticky and very plastic; common very fine and few fine roots; common very fine tubular pores and few very fine interstitial pores; continuous thick clay films in pores; strongly acid; abrupt, wavy boundary.

C1m—13 to 28 inches, red (2.5YR 4/6) indurated very gravelly hardpan; massive; few roots in cracks; thick continuous clay films nearly fill pores; medium acid; gradual, diffuse boundary.

IIC2—28 to 60 inches, stratified older mixed alluvium of sand to clay texture.

The A11 horizon ranges from 4 to 12 inches in thickness, from brown or strong brown to reddish yellow in color, from gravelly sandy loam to gravelly clay loam in texture, and from slightly acid to strongly acid in reaction. The A12 horizon is 0 to 4 inches thick. The B2t horizon ranges from 6 to 24 inches in thickness, from yellowish red or reddish brown to dark red in color, from gravelly heavy clay loam to gravelly clay or clay in texture, and from medium acid to strongly acid in reaction. The Cm horizon is at a depth of 10 to 30 inches. In places the IIC2 horizon is very cobbly.

Redding soils generally are near areas of Newtown, Clough, Igo, Perkins, and Red Bluff soils.

Redding gravelly loam, 0 to 3 percent slopes (RdA).—This soil has the profile described as representative for the series. Permeability is very slow. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 2 to 5.5 inches. Some available water is held above the hardpan during the early part of the growing season. The hardpan is at a depth of 10 to 30 inches.

Included with this soil in mapping were small areas of Clough, Igo, and Red Bluff soils. Also included were areas of soils that have a clay subsoil but lack the hardpan.

This Redding soil is used as range and dryland pasture. Capability unit IVs–8(17); Acid Terrace range site; woodland suitability group, not assigned; wildlife group 5.

Redding gravelly loam, 3 to 8 percent slopes (RdB).—This soil has very slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 2 to 5.5 inches. Some available water is held immediately above the hardpan during the early part of the growing season. The hardpan is at a depth of 10 to 30 inches.

Included with this soil in mapping were areas of Clough, Igo, Newtown, and Red Bluff soils. Also included were areas of soils that have a clay subsoil but lack a hardpan.

This Redding soil is used as range and dryland pasture. Capability unit IVe-8(17, 18); Acid Terrace range site; woodland suitability group, not assigned; wildlife group 5.

Redding-Red Bluff gravelly loams, 0 to 3 percent slopes (ReA).—About 45 percent of this complex is Redding gravelly loam, 0 to 3 percent slopes, and 40 percent is Red Bluff gravelly loam, 0 to 3 percent slopes (fig. 6). The remaining 15 percent consists of inclusions of Igo and Moda soils in intermound areas.

The Redding soil has a profile similar to that described as representative for the Redding series. It has very slow permeability. Available water capacity is 2 to 5.5 inches. The hardpan is at a depth of 10 to 30 inches.

The Red Bluff soil has a profile similar to the one described as representative for the Red Bluff series, except that it is 24 to 36 inches deep over a silica-indurated gravelly or cobbly substratum. Permeability is very slow. Available water capacity is 3.5 to 5.5 inches. The content of gravel is 15 to 35 percent throughout the profile.

Runoff is very slow on the soils of this unit. The hazard of erosion is none to slight.

Most of the areas of these soils are used as range and dryland pasture. Small areas are used as irrigated pasture. Capability unit IVs–8(17); Acid Terrace range site; woodland suitability group, not assigned; wildlife group 5.

Redding-Red Bluff gravelly loams, 3 to 8 percent slopes (ReB).—About 45 percent of this complex is Redding gravelly loam, 3 to 8 percent slopes, and 40 percent is Red Buff gravelly loam, 3 to 8 percent slopes. The remaining 15 percent consists of inclusions of Igo and Moda soils in intermound areas.

The Redding soil has a profile similar to that described as representative for the Redding series. It has very slow permeability. Available water capacity is 2 to 5.5 inches. The hardpan is at a depth of 10 to 30 inches.

The Red Buff soil has a profile similar to the one described as representative for the Red Bluff series, except that it is 24 to 36 inches deep to a silica-indurated gravelly or cobbly substratum. Permeability is very slow. Available water capacity is 3.5 to 5.5 inches. The content of gravel is 15 to 35 percent throughout the profile.

Runoff is slow to medium on the soils of this unit. The hazard of erosion is slight to moderate.

The areas of these soils are used as range and dryland pasture. Capability unit IVe–8(17, 18); Acid Terrace range site; woodland suitability group, not assigned; wildlife group 5.

Reiff Series

The Reiff series consists of well drained and moderately well drained soils that formed in recent alluvium from mixed sources. These soils are on low terraces and flood plains of the Sacramento River and the Cottonwood Creek in the central part of the survey area. Slopes are 0 to 8 percent. Elevation ranges from 350 to 500 feet. The annual precipitation is 25 to 40 inches, and the average annual air temperature is about 63° F. The 32° F. growing season is 250 to 275 days, and the 28° F. growing season is 325 to 340 days. The vegetation is a fairly dense cover of valley oak, canyon live oak, Digger pine, annual and perennial grasses, forbs, vines, and shrubs.

In a representative profile the surface layer is grayish-brown and brown, slightly acid fine sandy loam about 18

Figure 6.—Area of Redding-Red Bluff gravelly loams, 0 to 3 percent slopes. The Red Bluff soil is on mounds beneath the trees, and the Redding soil is in areas between the mounds.

inches thick. The substratum is brown, slightly acid fine sandy loam that grades, at a depth of about 43 inches, to brown, slightly acid loamy fine sand.

The areas of Reiff soils are used for field crops. They are also used extensively for residential and industrial development near the cities of Redding and Anderson.

Representative profile of Reiff fine sandy loam, 0 to 3 percent slopes, on a smooth, low terrace about 2 miles northeast of Anderson, ¼ mile east of the northwest corner of sec. 9, T. 30 N., R. 4 W.:

Ap1—0 to 2 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, thick, platy structure; soft, friable, nonsticky, and nonplastic; many very fine roots; common very fine tubular pores and many very fine interstitial pores; slightly acid; abrupt, wavy boundary.

Ap2—2 to 8 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots and few coarse roots; common very fine tubular pores and many very fine interstitial pores; slightly acid; clear, smooth boundary.

Ap3—8 to 18 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak, medium, subangular blocky structure; soft, friable, nonsticky and nonplastic; common very fine roots and few coarse roots; common very fine tubular pores and many very fine interstitial pores; slightly acid; clear, smooth boundary.

C1—18 to 29 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine roots, few coarse roots, and few very coarse roots; many very fine tubular pores and many very fine interstitial pores; slightly acid; gradual, smooth boundary.

C2—29 to 43 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable nonsticky and nonplastic; few very fine roots and few coarse roots; few very fine tubular pores and many very fine interstitial pores; slightly acid; gradual, smooth boundary.

C3—43 to 62 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots and few coarse roots; few very fine tubular pores and many very fine interstitial pores; slightly acid.

The A horizon ranges from 10 to 30 inches in thickness, from dark grayish brown to brown in color, from sandy loam to loam in texture, and from slightly acid to medium acid in reaction. It is gravelly in places. The C horizon ranges from

brown to light yellowish brown in color, from gravelly fine sandy loam to sandy loam, loam, or loamy fine sand in texture, and from slightly acid to neutral in reaction. At a depth of 40 to more than 60 inches, recent alluvium is stratified gravelly sand to sandy loam. In many places the surface layer has been compacted by tillage or trampling. In a few areas the soil is gravelly. In other areas the surface is too wet for optimum crop growth. Some areas are underlain by very gravelly sand at a depth of more than 40 inches. In this survey area, Reiff soils have darker colors, weaker consistence when dry, and a higher content of organic matter than Reiff soils recognized elsewhere in California.

Reiff soils generally are near areas of Anderson, Churn, Perkins, and Tehama soils and of Cobbly alluvial land and Wet alluvial land.

Reiff sandy loam, channeled, 0 to 8 percent slopes (RfB).—This soil has a profile similar to the one described as representative for the series, except that it consists of about 40 to 60 inches of sandy loam underlain by very gravelly sand. The soil is stratified in many areas. It is along the flood plains of Cottonwood Creek and Battle Creek. Stream channels are common, and the soil is subject to flooding for short periods in winter. The soil is well drained. Permeability is moderately rapid in the upper part and very rapid in the sand and gravel substratum below a depth of 40 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 5 to 8 inches.

Included with this soil in mapping were areas of Anderson and Tujunga soils and other Reiff soils.

This Reiff soil is used as dryland pasture. If protected by levees or other means, it is suitable for a variety of irrigated crops and for orchards. Capability unit IVw–2 (17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Reiff fine sandy loam, 0 to 3 percent slopes (RgA).—This soil has the profile described as representative for the series. The soil is well drained and has moderately rapid permeability. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 7.5 to 9 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of Anderson and Tujunga soils. Also included were areas of other Reiff soils.

This Reiff soil is used for irrigated hay and as irrigated and dryland pasture. Small areas are used for a variety of irrigated crops and orchards. Capability unit I–1(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Reiff fine sandy loam, 3 to 8 percent slopes (RgB).—This soil is well drained and has moderately rapid permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 7.5 to 9 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Tujunga soils, small areas of soils that have a very gravelly sand substratum, and areas of soils that have abandoned channels.

This Reiff soil is used for irrigated hay and as irrigated and dryland pasture. Capability unit IIe-1(17, 18); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Reiff fine sandy loam, deep, 0 to 3 percent slopes (RhA).—This soil has a profile similar to the one described as representative for the series, except that very gravelly sand is at a depth of 40 to more than 60 inches. It is well drained. Permeability is moderately rapid in the upper part and very rapid in the substratum. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 6 to 8 inches.

Included with this soil in mapping were small areas of Tujunga soils and other Reiff soils.

This Reiff soil is used for irrigated hay and as irrigated pasture. A few areas are used for other irrigated crops and for orchards. Capability unit IIs–0(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Reiff gravelly fine sandy loam, deep, 0 to 3 percent slopes (RkA).—This soil has a profile similar to the one described as representative for the series, except that very gravelly sand is at a depth of more than 60 inches, and the content of gravel is 15 to 35 percent in the surface layer. This soil is well drained. Permeability is moderately rapid in the upper part and very rapid in the very gravelly sand substratum. Runoff is slow, and the hazard of erosion is none to slight. Available water capacity is 4 to 5 inches.

Included with this soil in mapping were small areas of Honcut soils and other Reiff soils.

This Reiff soil is used for irrigated and dryland hay and as irrigated pasture. A few areas of this soil are also used for other irrigated crops and for orchards. Capability unit IIIs–0(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Reiff loam, 0 to 3 percent slopes (RlA).—This soil is loam throughout the profile, but its profile otherwise is similar to that described as representative for the series. It is well drained, and permeability is moderate. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 9.5 to 11 inches. Roots can penetrate to a depth of 60 inches or more.

Included with this soil in mapping were areas of Honcut soils and other Reiff soils. Also included, near the intersection of Balls Ferry Road and Anderson Creek, were about 200 acres of a light clay loam soil.

This Reiff soil is used for irrigated hay and as irrigated pasture. Small areas are used for other irrigated crops and for orchards. Capability unit I–1(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Reiff loam, seeped, 0 to 3 percent slopes (RmA).—This soil has a profile similar to the one described as representative for the series, except that texture is loam throughout. This soil is moderately well drained and has a faintly to distinctly mottled, brown to pale-brown substratum. Permeability is moderate. Runoff water ponds on this soil. Erosion is not a hazard. A water table is at a depth of 4 to 5 feet in places because of seepage. Available water capacity is 9.5 to 11 inches.

Included with this soil in mapping were areas of Honcut soils and other Reiff soils.

This Reiff soil is used for irrigated hay and as irrigated pasture. Small areas are used for other irrigated crops. Capability unit IIw–2(17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Reiff gravelly loam, 0 to 3 percent slopes (RnA).—This soil has a profile similar to the one described as representative for the series, except that the content of gravel is

15 to 35 percent throughout the profile. This soil is well drained and has moderately rapid permeability. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 7 to 8.5 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of soils that have a cobbly loam or a gravelly sandy loam surface layer and areas of other Reiff soils.

This Reiff soil is used for irrigated hay and as irrigated pasture. A few small areas are used for other irrigated crops and for orchards. Capability unit IIs–4(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Reiff gravelly loam, slightly wet, 0 to 3 percent slopes (RoA).—This soil has a profile similar to the one described as representative for the series, except that it has mottles that are faint to distinct and yellowish brown to pale brown. Also, the content of gravel is 15 to 35 percent throughout the profile. Permeability is moderately rapid in this soil. Runoff is very slow or water ponds on the surface. Erosion is not a hazard. Available water capacity is 7 to 8.5 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of Anderson soils and of other Reiff soils.

This Reiff soil is used for irrigated hay and as irrigated and dryland pasture. Small areas are used for other irrigated crops. Capability unit IIw–2(17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Riverwash

Riverwash (Rw) is nearly level or gently sloping and is in stream channels and adjacent areas. It is subject to continuous or frequent flooding, so plants do not become established. Most of this land type is in the central part of the survey area from Cottonwood to Redding and Bella Vista. Elevation ranges from 350 to 600 feet. Willow, cottonwood, interior live oak, valley oak, and wild grape and blackberry plants are along the channel banks in most places.

This land type is excessively drained and has rapid permeability. Runoff is very slow, and the hazard of erosion is very high.

Riverwash has little or no potential for farming. It is a source of sand and gravel for roads and for construction work. It is also used for recreation. Capability unit VIIIw–1(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 10.

Rock Land

Rock land (RxF) is nearly level to very steep and is on uplands in the mountainous parts of the survey area. Elevation ranges from 700 to 6,900 feet. Rock outcrops cover 25 to 90 percent of the surface. The appreciable amount of rock outcrop and the very shallow soil in the areas submerge the other characteristics of the soil. The rock consists of shale, sandstone, conglomerate, limestone, greenstone quartz diorite, andesite, basalt, rhyolite, schist, gneiss, serpentine, or peridotite.

The vegetation, where present, is similar to that on adjacent soils, except that Rock land has less grass and more drought-resistant plant species, such as canyon live oak, manzanita, toyon, buckeye, and yerba santa.

Small areas of adjacent soils commonly were included with this unit in mapping. Rock land is used as watershed and for recreation. Capability unit VIIIs–1(15, 18, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 8.

Rubble Land

Rubble land (RyF) is nearly level to very steep and is on uplands in the eastern part of the survey area southeast of Round Mountain. Elevation ranges from 3,000 to 5,000 feet. Stones and boulders cover 90 percent or more of the surface. The vegetation is open stands of shrubs, white fir, Douglas-fir, and incense cedar.

This land type generally is near areas of Cohasset, Cone, and McCarthy soils. Included in mapping were small areas of these soils.

This land type generally is used for water supply. A few trees grow in places. Capability unit VIIIs–1(15, 18, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 8.

Sehorn Series

The Sehorn series consists of well-drained soils that are underlain by sedimentary rocks. These soils are on uplands in the eastern and western parts of the survey area along the tributaries of Cow Creek east of Millville and Bella Vista and in the Bald Hills south of Ono. Slopes range from 3 to 70 percent. Elevation ranges from 800 to 1,600 feet. The annual precipitation is 25 to 35 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 275 to 325 days. The vegetation is grasses or, in a few places, grass-oak.

In a representative profile the surface layer is light olive-brown, slightly acid silty clay about 20 inches thick. The substratum is mottled, grayish-brown, light olive-brown, and yellowish-brown, neutral silty clay loam. Weathered calcareous shale is at a depth of about 28 inches.

The areas of Sehorn soils are used as range, dryland pasture, and wildlife habitat and for watershed.

Representative profile of Sehorn very stony silty clay, 8 to 30 percent slopes, eroded, about 5 miles northeast of Millville, 300 feet south of N¼ corner of sec. 20, T. 32 N., R. 2 W.:

A11—0 to 1 inch, grayish-brown (2.5Y 5/2) very stony heavy clay loam, olive brown (2.5Y 4/4) moist; weak, thin, platy structure; very hard, firm, slightly sticky and plastic; many very fine roots; many very fine tubular pores; cracks about ½ inch to 1½ inches wide; medium acid; abrupt, smooth boundary.

A12—1 to 11 inches, light olive-brown (2.5Y 5/4) silty clay, olive brown (2.5Y 4/4) moist; strong, very coarse, prismatic structure; extremely hard, very firm, sticky and very plastic; common very fine roots; common very fine tubular pores; slightly acid; clear, smooth boundary.

A13—11 to 20 inches, light olive-brown (2.5Y 5/4) silty clay, olive brown (2.5Y 4/4) with vertical streaks of yellowish brown, ½ to ¾ inch wide, along cracks moist; strong, very coarse, prismatic structure; extremely hard, very firm, slightly sticky and very plastic; com-

mon very fine tubular pores; common indistinct slickensides; slightly acid; clear, smooth boundary.

C—20 to 28 inches, mottled, grayish-brown (2.5Y 5/2), light olive brown (2.5Y 6/4), and yellowish-brown (10YR 5/6) silty clay loam, mottled, olive brown (2.5Y 4/4), dark grayish brown (2.5Y 4/2), and yellowish brown (10YR 5/4) moist; strong, fine, angular blocky structure; very hard, firm, slightly sticky and plastic; few very fine roots and common coarse roots; common very fine tubular pores; neutral; weakly effervescent in places; gradual, smooth boundary.

R—28 inches, weathered calcareous shale; moderately alkaline; strongly effervescent.

The A horizon ranges from 8 to 20 inches in thickness, from grayish brown to very pale brown or light olive brown in color, from heavy clay loam to silty clay in texture, and from neutral to medium acid in reaction. The C horizon ranges from 8 to 30 inches in thickness, from mottled yellowish brown and grayish brown to pale brown and light olive brown in color, from silty clay loam to clay in texture, and from medium acid to mildly alkaline in reaction. Bedrock of shale, siltstone, or sandstone is at a depth of 16 to 48 inches. It is calcareous in places. A few areas have a non-stony surface layer.

Sehorn soils generally are near areas of Churn, Kilarc, Lodo, Millsap, Millsholm, Myers, and Tehama soils.

Sehorn silty clay, 3 to 8 percent slopes (ScB).—This soil has slow permeability. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 5 to 9 inches. Weathered bedrock is at a depth of 30 to 48 inches. Stones cover less than 3 percent of the surface.

Included with this soil in mapping were areas where weathered bedrock is at a depth of 48 to more than 60 inches. Also included were small areas of Myers and Tehama soils.

This Sehorn soil is used as range and dryland pasture. Capability unit IIIe-5(15); Clayey range site; woodland suitability group, not assigned; wildlife group 4.

Sehorn silty clay, 8 to 30 percent slopes (ScD).—This soil has slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 4.5 to 7 inches. Weathered bedrock is at a depth of 28 to 40 inches and limits root peneration. Stones cover less than 3 percent of the surface.

Included with this soil in mapping were small areas of Kilarc, Lodo, and Millsholm soils; areas of Myers soils east of the Sacramento River; and areas of Tehama soils in areas of the Bald Hills.

This soil is used as range and dryland pasture. Capability unit IVe-5(15); Clayey range site; woodland suitability group, not assigned; wildlife group 4.

Sehorn silty clay, 30 to 50 percent slopes (ScE).—This soil has slow permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 4.5 to 7 inches. Weathered shale is at a depth of 28 to 40 inches.

Included with this soil in mapping were small areas of Landslides and of Lodo, Millsap, and Millsholm soils.

This soil is used as range and wildlife habitat and for watershed. Capability unit VIe-1(15, 17, 18); Clayey range site; woodland suitability group, not assigned; wildlife group 4.

Sehorn very stony silty clay, 8 to 30 percent slopes, eroded (SdD2).—This soil has the profile described as representative for the series. Permeability is slow. Runoff is medium to rapid, and the hazard of further erosion is moderate to high. Available water capacity is 4.5 to 7 inches. Weathered bedrock is at a depth of 28 to 40 inches.

Included with this soil in mapping were small areas of Kilarc, Millsholm, Myers, and Lodo soils.

This soil is used as range and wildlife habitat and for watershed. Capability unit VIs 1(15, 18); Clayey range site; woodland suitability group, not assigned; wildlife group 4.

Sehorn silty clay, moderately deep, 8 to 30 percent slopes (SeD).—This soil has slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 2.5 to 5 inches. Weathered bedrock is at a depth of 16 to 28 inches.

Included with this soil in mapping were areas of Millsap, Millsholm, and Tehama soils and areas of Landslides.

This soil is used as range and wildlife habitat and for watershed. Capability unit IVe-5(15); Clayey range site; woodland suitability group, not assigned; wildlife group 4.

Sehorn silty clay, moderately deep, 30 to 50 percent slopes (SeE).—This soil has slow permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 2.5 to 5 inches. Weathered bedrock is at a depth of 16 to 28 inches.

Included with this soil in mapping were areas of Lodo, Millsap, and Tehama soils and areas of Landslides.

This soil is used as range and wildlife habitat and for watershed. Capability unit VIe-1(15, 17, 18); Clayey range site; woodland suitability group, not assigned; wildlife group 4.

Sehorn complex, 50 to 70 percent slopes, eroded (SfF2).—About 40 percent of this complex is Sehorn silty clay, 50 to 70 percent slopes, and 40 percent is Sehorn silty clay, moderately deep, 50 to 70 percent slopes. The remaining 20 percent consists of inclusions of very stony Sehorn soils and of Lodo, Millsap, and Millsholm soils and of areas of Landslides. Each of these Sehorn soils has a profile similar to that described as representative for the series.

Sehorn silty clay is 28 tc 40 inches deep to weathered bedrock. Available water capacity is 4.5 to 7 inches.

Sehorn silty clay, moderately deep, is 16 to 28 inches deep to weathered bedrock. Available water capacity is 2.5 to 5 inches.

Both of the major soils in this unit have slow permeability. Runoff is very rapid, and the hazard of further erosion is very high.

The areas of these soils are used as range and wildlife habitat and for watershed. Capability unit VIIe-1(15, 18); Clayey range site; woodland suitability group, not assigned; wildlife group 4.

Sheetiron Series

The Sheetiron series consists of well-drained and somewhat excessively drained soils that are underlain by sedimentary or metamorphic rock. These soils are on uplands in the southwestern part of the survey area near Platina and Ono. Slopes range from 30 to 90 percent. Elevation ranges from 1,000 to 5,000 feet. The annual precipitation is 30 to 45 inches, and the average annual air temperature is about 52° F. The 32° F. growing season is 125 to 200 days, and the 28° F. growing season is 200 to 300 days. The vegetation is ponderosa pine, sugar pine, Douglas-fir, white fir, incense cedar, canyon live oak, and black oak.

In a representative profile the surface layer is gray and light-gray, medium acid very stony loam and very gravelly loam about 9 inches thick. The subsoil is light-gray, medium acid gravelly loam and very pale brown, very

strongly acid very gravelly loam. Fractured slate is at a depth of about 22 inches.

The areas of Sheetiron soils are used as woodland and wildlife habitat and for watershed.

Representative profile of Sheetiron very stony loam, 50 to 75 percent slopes, north of Platina, 2,700 feet south of the northwest corner of sec. 16, T. 30 N., R. 9 W.:

A11—0 to 4 inches, gray (10YR 5/1) very stony light loam, very dark gray (10YR 3/1) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; very few very fine roots; many fine interstitial pores; medium acid; abrupt, smooth boundary.

A12—4 to 9 inches, light-gray (2.5Y 7/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; common fine interstitial pores; medium acid; clear, smooth boundary.

B21—9 to 16 inches, light-gray (2.5Y 7/2) gravelly loam, grayish brown (2.5Y 5/2) moist; weak, fine, granular structure; soft, very friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots; common fine interstitial pores; medium acid; gradual, smooth boundary.

B22—16 to 22 inches, very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) moist; weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; few very fine and fine roots; common fine interstitial pores; very strongly acid; gradual, smooth boundary.

R—22 inches, very fractured weathered slate.

The A horizon ranges from 6 to 10 inches in thickness, from dark brown to light gray in color, from gravelly loam to very gravelly loam in texture, and from slightly acid to strongly acid in reaction. The B horizon ranges from 12 to 30 inches in thickness, from brown to very pale brown or light gray in color, and from gravelly loam to very gravelly light clay loam in texture. Bedrock of shale, sandstone, slate, or schist is at a depth of 18 to 40 inches. These soils are very stony on the surface. The B22 horizon of these soils contains more gravel than that of Sheetiron soils recognized elsewhere in California.

Sheetiron soils generally are near areas of Josephine, Marpa, Maymen, and Millsholm soils.

Sheetiron very stony loam, 30 to 50 percent slopes (SgE).—This soil is well drained and has moderately rapid permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 2 to 5 inches. Fractured bedrock is at a depth of 20 to 40 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were small areas of Josephine, Marpa, Millsholm, and Neuns soils.

This Sheetiron soil is used as woodland and wildlife habitat and for watershed. Capability unit VIs–1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Sheetiron very stony loam, 50 to 75 percent slopes (SgF).—This soil has the profile described as representative for the series. It is somewhat excessively drained and has moderately rapid permeability. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 2 to 3.5 inches. Fractured bedrock is at a depth of 18 to 30 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were areas of Josephine, Marpa, Millsholm, and Neuns soils.

This Sheetiron soil is used mainly as woodland and wildlife habitat and for watershed. Capability unit VIIs-1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Sheetiron very stony loam, 75 to 90 percent slopes (SgG).—This soil is somewhat excessively drained. Permeability is moderately rapid. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 2 to 3.5 inches. Fractured bedrock is at a depth of 18 to 30 inches. Stones cover 3 to 15 percent of the surface.

Included with this soil in mapping were areas of Josephine, Marpa, Millsholm, and Neuns soils.

This Sheetiron soil is used for watershed and as wildlife habitat. Capability unit VIIIs–1(15, 18, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 8.

Shingletown Series

The Shingletown series consists of somewhat poorly drained soils that formed in dominantly basic alluvium. These soils are in mountain valleys in the eastern part of the survey area from Montgomery Creek to Viola. Slopes are 0 to 8 percent. Elevation ranges from 2,000 to 6,000 feet. The annual precipitation is 35 to 50 inches, and the average annual air temperature is about 54° F. The 32° F. growing season is 100 to 225 days, and the 28° F. growing season is 150 to 250 days. The vegetation is annual and perennial grasses, sedges, and wiregrass.

In a representative profile the surface layer is dark-brown and dark grayish-brown, medium acid and slightly acid loam about 16 inches thick. The upper part of the subsoil, to a depth of about 46 inches, is light brownish-gray, slightly acid loam and pale-brown, neutral heavy sandy loam. To a depth of about 59 inches, the subsoil is very pale brown, neutral heavy sandy clay loam. The lower part of the subsoil, below a depth of about 59 inches, is light-gray, neutral gravelly clay loam, that extends to a depth of more than 60 inches.

The areas of Shingletown soils are used as pasture and wildlife habitat.

Representative profile of Shingletown loam, drained, 0 to 3 percent slopes, about 3½ miles west of McCumber Reservoir on Poorman Flat, ¼ mile northwest of the S¼ corner of sec. 7, T. 31 N., R. 2 E.:

A11—0 to 6 inches, dark-brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and slightly plastic; many very fine roots; many medium and few fine tubular pores; sandy loam texture in upper 1 inch of horizon; medium acid; clear, smooth boundary.

A12—6 to 16 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/3) moist; common, fine, distinct, yellowish-red mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few fine and common medium tubular pores; slightly acid; clear, smooth boundary.

B11—16 to 34 inches, light brownish-gray (10YR 6/2) loam, dark brown (10YR 4/3) moist; common, fine, distinct, strong-brown and dark-brown mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many fine tubular pores; few thin clay films in pores; slightly acid; diffuse, smooth boundary.

B12—34 to 46 inches, pale-brown (10YR 6/3) heavy sandy loam, dark brown (10YR 4/3) moist; common, fine, faint, light yellowish-brown mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine, fine, and medium tubular pores; few thin clay films in tubular pores; neutral; clear, smooth boundary.

B2t—46 to 59 inches, very pale brown (10YR 7/3) heavy sandy clay loam, brown (10YR 5/3) rubbed and moist; common, medium, distinct, brownish-yellow mottles; strong, coarse, angular blocky structure; hard, firm,

sticky and plastic; many fine and medium tubular pores and few fine interstitial pores; common moderately thick clay films in pores; common thin clay films on ped faces; neutral; abrupt, smooth boundary.

B3—59 to 65 inches, light-gray (10YR 7/2) gravelly clay loam, brown (10YR 5/3) moist; common, medium, distinct, yellowish-brown mottles; massive; hard, firm, sticky and plastic; common very fine and fine tubular pores and many very fine interstitial pores; common moderately thick clay films in pores; neutral.

The A horizon ranges from 8 to 16 inches in thickness, from very dark gray to dark brown or grayish brown in color, from loam to clay loam in texture, and from medium acid to mildly alkaline in reaction. The B2t horizon ranges from 12 to 40 inches in thickness, from dark gray to very pale brown in color, from sandy clay loam to clay loam in texture, and from slightly acid to mildly alkaline in reaction. A few areas are underlain, at a depth of 40 to 60 inches, by sandstone, tuff, or basalt. The C horizon, where present, generally is gravelly loam or stony clay loam.

Shingletown soils generally are near areas of Aiken, Cohasset, Kilarc, McCarthy, and Sites soils.

Shingletown clay loam, 0 to 8 percent slopes (ShB).—This soil has a profile similar to that described as representative for the series, except that its surface layer is silt loam to clay loam. Permeability is moderately slow. Runoff is very slow to slow, and the hazard of erosion is none to slight. Available water capacity is 7 to 12 inches. A seasonal high water table is at a depth of 3 to 5 feet. Sandstone, tuff, or basalt is at a depth of 40 to 60 inches.

Included with this soil in mapping were small areas of Shingletown loam, drained, and of Cohasset, Kilarc, and McCarthy soils. Also included were areas of a poorly drained soil that has a thick organic surface layer.

This Shingletown soil is used as pasture and wildlife habitat. Capability unit IIw–2(17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 7.

Shingletown loam, drained, 0 to 3 percent slopes (SkA).—This soil has the profile described as representative for the series. This soil has been artificially drained, as a means of controlling its high water table, but the water table is subject to return to its original level. Permeability is moderately slow. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 8 to 10 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Cohasset and McCarthy soils. Also included were areas of a shallow sandy loam that is underlain by volcanic rock.

This Shingleton soil is used as dryland and irrigated pasture and wildlife habitat. Capability unit IIw–2(17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 7.

Sierra Series

The Sierra series consists of well-drained soils that are underlain by weathered granitic bedrock. These soils are on uplands in the southwestern part of the survey area near Igo and Ono. Slopes range from 3 to 50 percent. Elevation ranges from 900 to 1,200 feet. The annual precipitation is 30 to 35 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 225 days, and the 28° F. growing season is 300 to 330 days. The vegetation is blue oak, interior live oak, poison oak, Digger pine, and annual grasses.

In a representative profile the surface layer is dark grayish-brown, slightly acid sandy loam and brown, medium acid loam about 10 inches thick. The subsoil is brown and reddish brown, medium acid clay loam. Weathered granodiorite is at a depth of about 43 inches.

The areas of Sierra soils are used for field crops and watershed and as wildlife habitat.

Representative profile of Sierra sandy loam, 8 to 15 percent slopes, on the right-of-way of the county road 1¼ miles west of Igo:

A11—0 to 4 inches, dark grayish-brown (10YR 4/2) sandy loam, dark brown (10YR 3/3) moist; weak, medium and coarse, granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; slightly acid; clear, smooth boundary.

A12—4 to 10 inches, brown (10YR 4/3) loam, dark brown (7.5YR 3/4) moist; massive; hard, friable, nonsticky and slightly plastic; common very fine roots and few fine roots; many very fine interstitial pores and common very fine tubular pores; medium acid; clear, smooth boundary.

B1t—10 to 15 inches, brown (7.5YR 4/3) light clay loam, dark brown (7.5YR 3/2) with common coatings of dark reddish brown (5YR 3/4) moist; massive; very hard, friable, nonsticky and slightly plastic; many very fine interstitial pores and common very fine tubular pores; common thin clay films in pores; medium acid; clear, wavy boundary.

B21t—15 to 21 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; weak, fine, subangular blocky structure; extremely hard, firm, slightly sticky and plastic; common very fine and few fine and medium roots; common very fine interstitial and tubular pores; common thin and moderately thick clay films in pores; medium acid; clear, smooth boundary.

B22t—21 to 32 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate, fine, subangular blocky structure; extremely hard, firm, slightly sticky and plastic; few very fine and fine roots; common very fine tubular pores and few very fine interstitial pores; common moderately thick clay films in pores and on ped faces; medium acid; clear, wavy boundary.

B3t—32 to 43 inches, reddish-brown (5YR 4/4) light clay loam, dark reddish brown (5YR 3/4) moist; massive; very hard, friable, nonsticky and slightly plastic; few very fine and fine roots; common very fine tubular pores and few very fine interstitial pores; common moderately thick clay films in pores; medium acid; clear, wavy boundary.

C—43 inches, weathered granodiorite that has original rock structure.

The A horizon ranges from 7 to 15 inches in thickness, from dark grayish brown to pale brown in color, from sandy loam to loam in texture, and from slightly acid to strongly acid in reaction. The B2t horizon ranges from 15 to 30 inches in thickness, from red to reddish brown in color, and from medium acid to strongly acid in reaction. The C horizon is at a depth of 40 to more than 60 inches and is weathered granodiorite. In a few severely eroded areas, this soil is as shallow as 30 inches to weathered granitic bedrock.

Sierra soils generally are near areas of Auberry, Auburn, Chaix, Gaviota, and Goulding soils.

Sierra sandy loam, 3 to 8 percent slopes (SmB).—This soil has moderately slow permeability. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Available water capacity is 7 to 12 inches. Weathered bedrock is at a depth of 40 to more than 60 inches.

Included with this soil in mapping were small areas of

Auberry soils and areas of a shallow, pale-brown, sandy loam.

This Sierra soil is used as irrigated and dryland pasture and as range. Small areas are used for other irrigated crops and for orchards. Capability unit IIe–1(17, 18); Granitic range site; woodland suitability group, not assigned; wildlife group 5.

Sierra sandy loam, 8 to 15 percent slopes (SmC).—This soil has the profile described as representative for the series. Permeability is moderately slow. Runoff is medium, and the hazard of erosion is moderate. Available water capacity is 7 to 12 inches. Weathered bedrock is at a depth of 40 to more than 60 inches.

Included with this soil in mapping were small areas of Auberry soils and of a shallow, pale-brown, sandy loam.

This Sierra soil is used as irrigated and dryland pasture and as range. Capability unit IIIe–1(17, 18); Granitic range site; woodland suitability group, not assigned; wildlife group 5.

Sierra sandy loam, 15 to 30 percent slopes (SmD).—This soil has moderately slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 7 to 12 inches. Weathered bedrock is at a depth of 40 to more than 60 inches.

Included with this soil in mapping were areas of Auberry soils and areas of a pale-brown, shallow, sandy loam.

This Sierra soil is used as range and wildlife habitat. Capability unit IVe–1(18); Granitic range site; woodland suitability group, not assigned; wildlife group 5.

Sierra sandy loam, 15 to 30 percent slopes, severely eroded (SmD3).—This soil has moderately slow permeability. Runoff is medium to rapid, and the hazard of further erosion is moderate to high. Available water capacity is 5.5 to 9.5 inches. Most of the surface layer has been lost through erosion, and weathered bedrock is at a depth of 30 to 48 inches, which is shallower than that for Sierra soils recognized elsewhere in California.

Included with this soil in mapping were small areas of Auberry soils and a shallow, pale-brown, sandy loam.

This Sierra soil is used as range and wildlife habitat. Capability unit VIe–1(15, 17, 18); Granitic range site; woodland suitability group, not assigned; wildlife group 5.

Sierra sandy loam, 30 to 50 percent slopes (SmE).—This soil has moderately slow permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 7 to 12 inches. Weathered bedrock is at a depth of 40 to more than 60 inches.

Included with this soil in mapping were areas of Auberry soils and a shallow, pale-brown, sandy loam.

This Sierra soil is used as range and wildlife habitat and for watershed. Capability unit VIe–1(15, 17, 18); Granitic range site; woodland suitability group, not assigned; wildlife group 5.

Sites Series

The Sites series consists of well-drained soils that are underlain by sedimentary or metamorphic rock. They are on uplands in the eastern part of the survey area from Big Bend to Shingletown and near Ono. Slopes range from 5 to 70 percent. Elevation ranges from 1,000 to 4,000 feet. The annual precipitation is 30 to 70 inches, and the average annual air temperature is about 54° F. The 32° F. growing season is 150 to 225 days, and the 28° F. growing season is 200 to 275 days. The vegetation is mixed conifers, oaks, shrubs, and grasses.

In a representative profile the surface layer is reddish-brown, medium acid loam about 14 inches thick. The subsoil is yellowish-red, very strongly acid clay loam and clay that grades, at a depth of about 41 inches, to strong-brown, very strongly acid clay loam. The underlying material, at a depth of 63 inches, is light yellowish-brown, very strongly acid sandy loam.

The areas of Sites soils are used as woodland, range, and wildlife habitat and for watershed.

Representative profile of Sites loam, 15 to 30 percent slopes, 2½ miles southwest of Big Bend on the east side of Big Bend road, about 50 yards north of the telephone line crossing, in the NW¼ sec. 13, T. 36 N., R. 1 W.:

O–1 inch to 0, litter and humus from virgin cover of mixed conifers and woody shrubs; strongly acid; abrupt, smooth boundary.

A11—0 to 2 inches, reddish-brown (5YR 4/3) loam, dark brown (7.5YR 3/2) moist; strong, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; some fine concretions; medium acid; clear, smooth boundary.

A12—2 to 6 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/4) moist; strong, fine, granular structure; soft, very friable, slightly sticky and nonplastic; many very fine roots; common very fine interstitial pores; common fine concretions; medium acid; clear, wavy boundary.

A3—6 to 14 inches, reddish-brown (5YR 4/3) loam, reddish brown (5YR 4/4) moist; strong, fine and medium, granular structure; slightly hard, friable, slightly sticky and nonplastic; common fine roots; common very fine interstitial pores; common fine concretions; medium acid; clear, smooth boundary.

B21t—14 to 27 inches, yellowish-red (5YR 5/6) heavy clay loam, yellowish red (5YR 4/6) moist; strong, medium, angular blocky structure; hard, extremely firm, sticky and plastic; very few medium and few fine roots; few fine interstitial pores; continuous thin clay films in pores; very strongly acid; gradual, smooth boundary.

B22t—27 to 41 inches, yellowish-red (5YR 4/6) clay, yellowish red (5YR 4/8) moist; weak, coarse, subangular blocky structure; hard, firm, sticky and plastic; very few very fine and fine roots; few very fine interstitial pores; continuous thin clay films in pores; very strongly acid; clear, wavy boundary.

B3—41 to 63 inches, strong-brown (7.5YR 5/6) clay loam, yellowish red (5YR 5/6) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; very few fine roots; common very fine vesicular pores; common thin clay bridges; very strongly acid; diffuse, wavy boundary.

C—63 to 72 inches, light yellowish-brown (10YR 6/4) sandy loam, strong brown (7.5YR 5/6) moist; massive; soft, very friable, slightly sticky and nonplastic; very few fine roots; common very fine vesicular pores; common thin clay bridges; very strongly acid; diffuse, wavy boundary.

The A horizon ranges from 9 to 14 inches in thickness, from dark grayish brown to reddish brown in color, from sandy loam to loam in texture, and from slightly acid to medium acid in reaction. The B2t horizon ranges from 25 to 40 inches in thickness, from yellowish red to dark red in color, and from medium acid to very strongly acid in reaction. The C horizon ranges from light yellowish brown or very pale brown to light red in color and from sandy loam to clay loam in texture. Weathered sandstone, conglomerate, or schist is at a depth of 4 to more than 5 feet. A few areas of this soil have stones on the surface.

Sites soils generally are near areas of Aiken, Cohasset, Guenoc, Josephine, Marpa, and Supan soils.

Sites loam, 5 to 15 percent slopes (SnC).—This soil has moderately slow permeability. Runoff is medium, and the hazard of erosion is moderate. Available water capacity is 7.5 to 11 inches. Weathered bedrock is at a depth of 48 to more than 60 inches.

Included with this soil in mapping were areas of Josephine, Kilarc, Millsholm, and Parrish soils. Also included were areas of a soil that has a surface layer of brown, strongly acid clay loam and a subsoil of grayish-brown and light yellowish-brown, extremely acid sandy clay loam underlain by shale.

This Sites soil is used as woodland. Capability unit IIIe-1(22); range site, not assigned; woodland suitability group 4; wildlife group 8.

Sites loam, 15 to 30 percent slopes (SnD).—This soil has the profile described as representative for the series. Permeability is moderately slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 7.5 to 11 inches. Weathered bedrock is at a depth to 48 to more than 60 inches.

Included with this soil in mapping were areas of Josephine, Kilarc, Millsholm, and Parrish soils. Also included were areas of a soil that has a surface layer of brown, strongly acid clay loam and a subsoil of grayish-brown and light yellowish-brown, extremely acid sandy clay loam underlain by shale.

This Sites soil is used as woodland and wildlife habitat and for watershed. Capability unit IVe-1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Sites loam, 30 to 50 percent slopes (SnE).—This soil has moderately slow permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 7.5 to 11 inches. Weathered bedrock is at a depth of 48 to more than 60 inches.

Included with this soil in mapping were small areas of Josephine, Kilarc, Millsholm, and Parrish soils. Also included were small areas of a soil that has a surface layer of brown, strongly acid sandy clay loam and a subsoil of grayish-brown and light yellowish-brown, extremely acid sandy clay loam underlain by shale.

This Sites soil is used mainly as woodland and wildlife habitat and for watershed. Capability unit VIe-1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Sites loam, 50 to 70 percent slopes (SnF).—This soil has moderately slow permeability. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 7.5 to 11 inches. Weathered bedrock is at a depth of 48 to more than 60 inches.

Included with this soil in mapping were areas of Josephine, Kilarc, Millsholm, and Parrish soils.

This Sites soil is used mainly as woodland and wildlife habitat and for watershed. Capability unit VIIe-1(22); range site, not assigned; woodland suitability group 6; wildlife group 8.

Sites stony loam, 8 to 30 percent slopes (SoD).—This soil has moderately slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 7.5 to 11 inches. Weathered bedrock is at a depth of 48 to more than 60 inches. Stones cover 1 to 3 percent of the surface.

Included with this soil in mapping were small areas of Josephine, Kilarc, Millsholm, and Parrish soils. Also included were small areas of a soil that has a surface layer of brown, strongly acid sandy clay loam and a subsoil of grayish-brown and light yellowish-brown, extremely acid sandy clay loam underlain by shale.

This Sites soil is used mainly as woodland and wildlife habitat and for watershed. Capability unit IVe-7(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Sites very rocky loam, 30 to 50 percent slopes (SpE).—This soil has moderately slow permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 7.5 to 11 inches. Weathered bedrock is at a depth of 48 to 60 inches. Bedrock outcrops cover 10 to 25 percent of the surface.

Included with this soil in mapping were areas of soils that have weathered bedrock at a depth of 30 to 48 inches. Also included were areas of Josephine, Kilarc, Millsholm, and Parrish soils. Other inclusions were small areas of a soil that has a surface layer of brown, strongly acid sandy clay loam and a subsoil of grayish-brown and light yellowish-brown, extremely acid sandy clay loam underlain by shale.

This Sites soil is used as woodland and wildlife habitat and for watershed. Capability unit VIs-1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Spreckels Series

The Spreckels series consists of well-drained soils that are underlain by a strongly cemented to indurated hardpan on mixed tuffaceous alluvium. They are on terraces or fans in the east-central part of the survey area near Millville, Palo Cedro, and along Oak Run Creek. Slopes are 0 to 8 percent. Elevation ranges from 500 to 800 feet. The annual precipitation is 30 to 35 inches, and the average annual air temperature is about 61° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 300 to 325 days. The vegetation is annual grasses and forbs and scattered blue oak, Digger pine, and manzanita.

In a representative profile the surface layer is brown, slightly acid and medium acid sandy loam, fine sandy loam, heavy loam, and sandy clay loam about 18 inches thick. The subsoil is grayish-brown and brown, strongly acid clay that extends to a depth of about 25 inches. Below the subsoil is a strongly cemented hardpan about 6 inches thick. Below the hardpan is consolidated tuffaceous alluvium.

The areas of Spreckels soils are used as pasture and for field crops.

Representative profile of Spreckels sandy loam, 3 to 8 percent slopes, about 4½ miles northeast of Palo Cedro, ¼ mile east of center of sec. 26, T. 32 N., R. 3 W.:

A11—0 to 2 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; moderate, medium, granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; slightly acid; abrupt, smooth boundary.

A12—2 to 7 inches, brown (10YR 5/3) fine sandy loam, dark brown (7.5YR 3/4) moist; massive; hard, friable, nonsticky and nonplastic; few very fine and very few fine roots; many very fine tubular and interstitial pores; slightly acid; clear, smooth boundary.

A31—7 to 15 inches, brown (10YR 5/3) heavy loam, dark brown (7.5YR) 3/4 moist; massive; hard, friable, nonsticky and slightly plastic; few very fine and very

few fine roots; many very fine tubular and interstitial pores; very few thin clay films as bridges; slightly acid; abrupt, smooth boundary.

A32—15 to 18 inches, brown (10YR 5/3) sandy clay loam, brown (7.5YR 4/3) moist; massive; hard, friable, sticky and plastic; very few fine roots; many very fine interstitial pores and common fine tubular pores; common moderately thick clay films as bridges; common concretions 1 to 2 millimeters in diameter; medium acid; abrupt, wavy boundary.

B2t—18 to 25 inches, grayish-brown and brown (10YR 5/2, 5/3) clay, dark grayish brown (10YR 4/2) moist; moderate, medium, columnar structure that parts readily to strong, medium, angular blocky structure; tops of columns have gray siliceous coatings extending one-half inch down sides of columns; very hard, very firm, sticky and very plastic; very few fine roots; few very fine tubular pores; continuous thick clay films on ped faces and in pores; strongly acid; abrupt, wavy boundary.

IIC1m—25 to 31 inches, mottled, light-gray, light brownish-gray, yellowish-brown, and very dark gray (10YR 7/1, 6/2, 5/4, N 3/0) strongly cemented hardpan, brown (10YR 4/3) moist; massive; many moderately thick clay films in cracks; strongly acid; diffuse, irregular boundary.

IIC2—31 to 60 inches, consolidated tuffaceous alluvium of mixed texture.

The A1 horizon ranges from 5 to 10 inches in thickness, from brown or grayish brown to pale brown in color, from sandy loam to loam in texture, and from slightly acid to medium acid in reaction. The A3 horizon is 8 to 18 inches thick. The B2t horizon ranges from 7 to 36 inches in thickness, from yellowish brown to grayish brown or brown in color, and from medium acid to strongly acid in reaction. A hardpan of strongly cemented to indurated tuffaceous sediment is at a depth of 20 to 36 inches. This soil is underlain by a hardpan and, therefore, differs from Spreckels soils recognized elsewhere in California.

Spreckels soils generally are near areas of Hillgate, Honn, Los Robles, Newtown, and Vina soils.

Spreckels sandy loam, 0 to 3 percent slopes (SrA).—This soil has slow permeability above the nearly impermeable hardpan. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 3.5 to 7 inches. The hardpan is at a depth of 20 to 36 inches.

Included with this soil in mapping were areas of Hillgate, Honn, and Moda soils.

This Spreckels soil is used mainly as dryland pasture. Small areas are used for other dryland crops. Capability unit IIIs-3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Spreckels sandy loam, 3 to 8 percent slopes (SrB).—This soil has the profile described as representative for the series. Permeability is slow above the nearly impermeable hardpan. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 3.5 to 7 inches. The hardpan is at a depth of 20 to 36 inches.

Included with this soil in mapping were small areas of Hillgate, Honn, and Moda soils.

This Spreckels soil is used mainly as dryland pasture. Small areas are used for other crops. Capability unit IIIe-3(17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Stonyford Series

The Stonyford series consists of well-drained soils that are underlain by greenstone. These soils are on uplands in the southwestern part of the survey area near Platina and Ono and near Whiskeytown Lake. Slopes range from 30 to 75 percent. Elevation ranges from 1,000 to 3,000 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 60° F. The 32° F. growing season is 150 to 200 days, and the 28° F. growing season is 200 to 300 days. The vegetation is chamise, manzanita, toyon, ceanothus, mountain-mahogany, and scrub oak.

In a representative profile the surface layer is brown and yellowish-red, medium acid very stony and gravelly loam about 8 inches thick. The subsoil is reddish-yellow, medium acid gravelly clay loam. Fractured greenstone is at a depth of about 24 inches.

The areas of Stonyford soils are used as range and wildlife habitat and for watershed.

Representative profile of Stonyford very stony loam, 50 to 75 percent slopes, about 3 miles southeast of French Gulch, 0.2 mile west and 0.2 mile south of the northeast corner of sec. 1, T. 32 N., R. 7 W.:

A11—0 to 2 inches, brown (7.5YR 5/4) very stony loam, dark reddish brown (5YR 3/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine tubular pores; medium acid; abrupt, smooth boundary.

A12—2 to 9 inches, yellowish-red (5YR 5/6) rubbed gravelly loam, dark yellowish brown (5YR 3/4) rubbed moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine roots and common medium roots; common fine tubular and interstitial pores; medium acid; gradual, smooth boundary.

B1—9 to 17 inches, reddish-yellow (5YR 6/6) gravelly light clay loam, yellowish red (5YR 4/6) moist; massive; slightly hard, friable, slightly sticky and plastic; few very fine, fine, and medium roots and common coarse roots; few fine tubular and interstitial pores; medium acid; gradual, smooth boundary.

B2t—17 to 24 inches, reddish-yellow (5YR 6/6) gravelly clay loam, yellowish red (5YR 4/6) moist; massive; slightly hard, friable, slightly sticky and plastic; few very fine, fine, medium, and coarse roots; few fine interstitial pores; common thin clay films on rock fragments; medium acid; abrupt, wavy boundary.

R—24 inches, fractured and weathered greenstone; soil material and clay films in cracks.

The A horizon ranges from 2 to 10 inches in thickness, from brown to reddish brown in color, from loam to gravelly loam in texture, and from neutral to medium acid in reaction. The B1 horizon is 7 to 10 inches thick. The B2t horizon ranges from 7 to 20 inches in thickness, from reddish brown to reddish yellow in color, from slightly acid to medium acid in reaction, and from clay loam to gravelly clay loam in texture. Fractured greenstone bedrock is at a depth of 16 to 25 inches. All areas of these soils are very stony.

Stonyford soils generally are near areas of Auburn, Boomer, Goulding, Marpa, Maymen, and Millsholm soils.

Stonyford very stony loam, 30 to 50 percent slopes (SsE).—This soil has moderate permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 2 to 3 inches. Fractured greenstone is at a depth of 16 to 25 inches. Stones cover 3 to 10 percent of the surface.

Included with this soil in mapping were small areas of Auburn, Boomer, Goulding, and Parrish soils.

This Stonyford soil is used for watershed and as wildlife habitat. Small areas are used as pasture. Capability unit VIIs-1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 6.

Stonyford very stony loam, 50 to 75 percent slopes (SsG).—This soil has the profile described as representative

for the series. Permeability is moderate. Runoff is very rapid, and the hazard of erosion is very high. Available water capacity is 2 to 3 inches. Fractured bedrock is at a depth of 16 to 25 inches.

Included with this soil in mapping were areas of Auburn, Boomer, Goulding, and Parrish soils.

This Stonyford soil is used mainly for range, for watershed, and as wildlife habitat. Capability unit VIIs–1(15, 17, 18); Shallow Loamy range site; woodland suitability group, not assigned; wildlife group 6.

Supan Series

The Supan series consists of well-drained soils that are underlain by tuffaceous breccia. These soils are on uplands in the east-central part of the survey area along the tributaries of Cow Creek from Oak Run and Whitmore to Millville and Black Butte. Slopes range from 0 to 50 percent. Elevation ranges from 800 to 2,000 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 52° F. The 32° F. growing season is 175 to 225 days, and the 28° F. growing season is 250 to 325 days. The vegetation is annual grasses, oaks, Digger pine, and shrubs.

In a representative profile the surface layer is dark grayish-brown, mildly alkaline and neutral very stony loam and loam about 10 inches thick. The subsoil is dark-brown, neutral and slightly acid gravelly clay loam. Tuff breccia is at a depth of about 33 inches.

The areas of Supan soils are used as dryland pasture, range, and wildlife habitat and for watershed.

Representative profile of Supan very stony loam, 0 to 30 percent slopes, about 1 mile south of Black Butte at the intersection of the PG&E pipeline and Black Butte Road, one-third mile northeast of center of sec. 20, T. 30 N., R. 1 W.:

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) very stony light loam, very dark grayish brown (10YR 3/2) moist; weak, medium, granular structure; slightly hard, friable, nonsticky and slightly plastic; many very fine and common fine roots; many very fine interstitial pores; few fine concretions, 1 millimeter in diameter; mildly alkaline; clear, smooth boundary.

A12—2 to 10 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak, medium, granular and moderate, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; many very fine and few coarse interstitial pores and common very fine tubular pores; neutral; clear, wavy boundary.

B2t—10 to 21 inches, dark-brown (7.5YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; weak, medium, granular and moderate, fine, subangular blocky structure; slightly hard, firm, sticky and very plastic; few fine and medium roots and common very fine roots; many very fine tubular pores; many thin clay films in pores and as bridges; neutral; clear, wavy boundary.

B3t—21 to 33 inches, dark-brown (7.5YR 4/2) gravelly clay loam, dark brown (7.5YR 4/2, 4/4) moist; massive; hard, firm, brittle, sticky and plastic; few very fine roots; few very fine tubular pores; many moderately thick clay films on tuff fragments, common thin clay films in pores and as bridges; slightly acid; abrupt, irregular boundary.

R -33 inches, light-gray (10YR 6/1) tuff breccia.

The A horizon ranges from 6 to 16 inches in thickness, from brown to dark grayish brown in color, from loam to gravelly loam in texture, and from slightly acid to mildly alkaline in reaction. The B2t horizon ranges from 10 to 35 inches in thickness, from dark brown to reddish brown in color, from gravelly clay loam to cobbly clay loam in texture, and from mildly alkaline to medium acid in reaction. The B3 horizon is 8 to 15 inches thick. Tuff breccia or cemented tuffaceous sediment is at a depth of 24 to 40 inches. A few areas of these soils are not stony.

Supan soils generally are near areas of Guenoc, Inks, Pentz, Toomes, and Tuscan soils.

Supan gravelly loam, 5 to 15 percent slopes (StC).—This soil has moderately slow permeability. Runoff is medium, and the hazard of erosion is moderate. Available water capacity is 4 to 7 inches. The parent material is at a depth of 24 to 40 inches.

Included with this soil in mapping were areas where bedrock is at a depth of 40 to more than 60 inches. Also included were areas of Inks soils.

This Supan soil is used mainly as range and dryland pasture. Small areas are used as irrigated pasture. Capability unit IIIe–8(18); Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Supan gravelly loam, 15 to 30 percent slopes (StD).—This soil has moderately slow permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 4 to 7 inches. Bedrock is at a depth of 24 to 40 inches.

Included with this soil in mapping were areas of soils that have bedrock at a depth of 40 to more than 60 inches. Also included were areas of Aiken, Inks, and Toomes soils.

This Supan soil is used as range, dryland pasture, and wildlife habitat. Capability unit IVe–8(17, 18); Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Supan gravelly loam, 30 to 50 percent slopes (StE).—This soil has moderately slow permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 4 to 7 inches. Bedrock is at a depth of 24 to 40 inches.

Included with this soil in mapping were areas of soils that have bedrock at a depth of more than 40 inches. Also included were areas of Inks and Toomes soils.

This Supan soil is used as range and wildlife habitat and for watershed. Capability unit VIe–1(15, 17, 18); Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Supan very stony loam, 0 to 30 percent slopes (SuD).—This soil has the profile described as representative for the series. Permeability is moderately slow. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 4 to 7 inches. Bedrock is at a depth of 24 to 40 inches. Stones cover 3 to 10 percent of the surface.

Included with this soil in mapping were areas of other Supan soils and areas of Cohasset, Pentz, Toomes, and Tuscan soils.

This Supan soil is mainly used as range and wildlife habitat and for watershed. Capability unit VIs–1(15, 18); Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Supan very stony loam, 30 to 50 percent slopes (SuE).—This soil has moderately slow permeability. Runoff is rapid, and the hazard of erosion is high. Available water capacity is 4 to 7 inches. Bedrock is at a depth of 24 to 40 inches. Stones cover 3 to 10 percent of the surface.

Included with this soil in mapping were small areas of a

Supan very stony loam that has slopes of more than 50 percent.

This Supan soil is used as range and wildlife habitat and for watershed. Capability unit VIs–1(15, 18); Loamy range site; woodland suitability group, not assigned; wildlife group 5.

Tailings and Placer Diggings

Tailings and Placer diggings (TaD) consists of areas that have been mined for gold by placer mining or dredging. Dredger tailings are on flood plains or low terraces. They consist of long, parallel, steep ridges of cobblestones and gravel from 6 to 25 feet high and of a few long narrow troughs 5 to 25 feet deep that are filled with water in winter. In most places this land type is bare of vegetation, but thin stands of cottonwoods and willows are in some of the troughs. The areas of placer diggings are moderately steep and steep and are on high terraces. Slopes are very irregular; and random piles of cobblestones, 3 to 8 feet high, and many very steep, eroded slopes of gravelly and cobbly alluvium are present. In places the edges of the unit are banks 15 to 60 feet high. Vegetation generally is a dense cover of manzanita, poison oak, ceanothus, interior live oak, and Digger pine.

Most of these areas are in the central part of the survey area southwest of Redding near Clear Creek. Elevation ranges from 450 to 700 feet (fig. 7).

This land type is used for water supply. It has no potential for farming. Capability unit VIIIs–1(15, 18, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 10.

Tehama Series

The Tehama series consists of well-drained soils that formed in mixed alluvium. These soils are in the central part of the survey area in areas of the Bald Hills south of Ono, on bottoms of Churn Creek, on low terraces along Cottonwood Creek and Sacramento River, and along Jim Creek northeast of Bella Vista. Slopes range from 0 to 15 percent. Elevation ranges from 500 to 600 feet. The annual precipitation is 28 to 35 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 225 to 250 days, and the 28° F. growing season is 250 to 325 days. The vegetation is grasses or grass-oak, Digger pine, and manzanita.

In a representative profile the surface layer is pale-brown, medium acid and slightly acid loam about 30 inches thick. The upper part of the subsoil is pale-brown and light

Figure 7.—Area of Tailings and Placer diggings along Clear Creek.

yellowish-brown, neutral silty clay loam that grades, at a depth of about 45 inches, to yellowish-brown, neutral very gravelly clay loam.

The areas of Tehama soils are used as irrigated and dryland pasture.

Representative profile of Tehama loam, 0 to 3 percent slopes, about 11 miles west of Cottonwood, 660 feet west of E$\frac{1}{4}$ corner of sec. 2, T. 29 N., R. 6 W.:

Ap—0 to 7 inches, pale-brown (10YR 6/3) loam, dark yellowish brown (10YR 4/4) moist; massive; very hard, friable, nonsticky and slightly plastic; common very fine roots; many very fine tubular pores; medium acid; clear, smooth boundary.

A1—7 to 13 inches, pale-brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky and slightly plastic; few very fine roots; many very fine tubular pores; slightly acid; gradual, smooth boundary.

A3—13 to 30 inches, pale-brown (10YR 6/3) heavy loam, dark yellowish brown (10YR 4/4) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; slightly acid; clear, wavy boundary.

B1—30 to 39 inches, pale-brown (10YR 6/3), near very pale brown, light silty clay loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; common thin clay films in pores; neutral; clear, smooth boundary.

B21t—39 to 45 inches, mixed, pale-brown and light yellowish-brown (10YR 6/3, 6/4) silty clay loam, yellowish brown (10YR 5/4) and few manganese strains moist; massive; very hard, firm, slightly sticky and plastic; few very fine roots; common very fine tubular pores; common moderately thick clay films in pores; neutral; gradual, smooth boundary.

IIB22t—45 to 60 inches, yellowish-brown (10YR 5/4) very gravelly clay loam, dark brown (10YR 4/3) moist; massive; very hard (may be weakly cemented), firm, sticky and plastic; few very fine roots; common very fine tubular pores; common moderately thick clay films in pores; neutral.

The A1 horizon ranges from 12 to 25 inches in thickness and from light yellowish brown to pale brown in color. The B21t horizon ranges from pale brown to yellowish brown in color, from silty clay loam to clay loam in texture, and from neutral to slightly acid in reaction. In places a C horizon of gravelly loam or very gravelly alluvium is at a depth of 48 to 60 inches and is weakly cemented or contains brittle nodules. Along Jim Creek, sedimentary rock is at a depth of 48 to more than 60 inches. The presence of rock at this depth is not typical for the Tehama soils recognized elsewhere in California.

Tehama soils generally are near areas of Anderson, Churn, Honcut, Moda, Newtown, and Perkins soils.

Tehama loam, 0 to 3 percent slopes (TbA).—This soil has the profile described as representative for the series. Permeability is slow. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 10 to 12 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Churn, Hillgate, Moda, and Perkins soils.

This Tehama soil is used as irrigated and dryland pasture. Small areas are used for other irrigated crops. Capability unit IIs–3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Tehama loam, 3 to 8 percent slopes (TbB).—This soil has a profile similar to the one described as representative for the series, except that sedimentary rock is at a depth of 48 to more than 60 inches. Permeability is slow. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 8.5 to 12 inches.

Included with this soil in mapping were some areas of Sehorn soils.

This Tehama soil is used mainly as dryland pasture. Capability unit IIe–3(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Tehama loam, 8 to 15 percent slopes (TbC).—This soil has a profile similar to the one described as representative for the series, except that sedimentary rock is at a depth of 48 to more than 60 inches. Permeability is slow. Runoff is medium, and the hazard of erosion is moderate. Available water capacity is 8.5 to 12 inches.

Included with this soil in mapping were small areas of Sehorn soils.

This Tehama soil is used mainly as dryland pasture. Capability unit IIIe–3(17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Toomes Series

The Toomes series consists of well-drained and somewhat excessively drained soils that are underlain by lava or tuff breccia. These soils are on foothills of the volcanic uplands in the eastern part of the survey area from Battle Creek to Oak Run and Ingot. Slopes range from 0 to 50 percent. Elevation ranges from 800 to 2,000 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is 60° F. The 32° F. growing season is 200 to 225 days, and the 28° F. growing season is 250 to 300 days. The vegetation is annual grasses and scattered blue oak, interior live oak, wedgeleaf ceanothus, manzanita, and Digger pine.

In a representative profile the surface layer is brown, slightly acid very stony and stony loam. Tuff breccia is at a depth of about 11 inches.

The areas of Toomes soils are used as range and wildlife habitat and for watershed.

Representative profile of Toomes very stony loam, 0 to 30 percent slopes, about 4½ miles west of Black Butte, one-fourth mile east of the northwest corner of sec. 15, T. 30 N., R. 2 W.:

A11—0 to 2 inches, brown (7.5YR 5/4) very stony loam, dark brown (7.5YR 3/2) moist; moderate, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine and fine interstitial pores; slightly acid; clear, wavy boundary.

A12—2 to 11 inches, brown (7.5YR 5/4) stony loam, dark brown (7.5YR 3/2) moist; weak, very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots and few fine and medium roots that spread out above the bedrock; common very fine tubular and interstitial pores; slightly acid; clear, wavy boundary.

R—11 inches, tuff breccia.

The A11 horizon ranges from 1 to 6 inches in thickness. The A12 horizon ranges from 3 to 16 inches in thickness and from slightly acid to medium acid in reaction. Tuff breccia is at a depth of 4 to 20 inches. All areas of these soils are very stony.

Toomes soils generally are near areas of Aiken, Cohasset, Guenoc, Inks, Supan, and Tuscan soils.

Toomes very rocky loam, 0 to 50 percent slopes (TcE).—This soil is somewhat excessively drained and has moderate permeability. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 0.5 to 1.5 inches. Bedrock is at a depth of 4 to 10 inches.

Rock outcrops and stones cover 15 to 25 percent of the surface.

Included with this soil in mapping were small areas of Guenoc and Supan soils. Also included were small areas of a shallow, yellowish-red soil that is underlain by lava rock. In these areas, rock outcrops cover 25 to 50 percent of the surface.

This Toomes soil is used as range and wildlife habitat and for watershed. Capability unit VIIs–1(15, 17, 18); Very Shallow Very Rocky range site; woodland suitability group, not assigned; wildlife group 3.

Toomes very stony loam, 0 to 30 percent slopes (TeD).—This soil has the profile described as representative for the series. It is well drained. Permeability is moderate. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is 0.5 to 2.5 inches. Bedrock is at a depth of 4 to 20 inches. Stones cover 10 to 20 percent of the surface.

Included with this soil in mapping were areas of Guenoc and Supan soils.

This Toomes soil is used for watershed and as range and wildlife habitat. Capability unit VIIs–1(15, 17, 18); Very Shallow Very Rocky range site; woodland suitability group, not assigned; wildlife group 5.

Tujunga Series

The Tujunga series consists of somewhat excessively drained soils that formed in mixed alluvium. These soils are on flood plains or on fans in the central part of the survey area along Cottonwood Creek and the Sacramento River. Slopes are 0 to 8 perent. Elevation ranges from 350 to 500 feet. The annual precipitation is 25 to 35 inches, and the average annual air temperature is about 64° F. The 32° F. growing season is 250 to 275 days, and the 28° F. growing season is 300 to 325 days. The vegetation is annual grasses and forbs and scattered ceanothus, coffeeberry, valley oak, interior live oak, and Digger pine.

In a representative profile the surface layer is pale-brown, slightly acid loamy sand about 14 inches thick. The substratum is mixed, pale-brown, brown, and light yellowish-brown, slightly acid sand to a depth of 27 inches. It is pale-brown, slightly acid very gravelly loamy sand to a depth of 37 inches. This layer is underlain by brown, slightly acid very cobbly sand to a depth of more than 60 inches.

The areas of Tujunga soils are used for field crops.

Representative profile of Tujunga loamy sand, 0 to 3 percent slopes, about 2½ miles northwest of Anderson, 800 feet southwest of the Sacramento River, 4,400 feet west of southeast corner of sec. 4, T. 30 N., R. 4 W.:

Ap—0 to 14 inches, pale-brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many fine interstitial pores; slightly micaceous; slightly acid; gradual, smooth boundary.

C1—14 to 27 inches, mixed, pale-brown, brown, and light yellowish-brown (10YR 6/3, 5/3, 6/4) sand, pale brown and brown (10YR 6/3, 4/3) moist; single grain; loose (dry and moist), nonsticky and nonplastic; few very fine roots; many fine interstitial pores; slightly acid; abrupt, wavy boundary.

C2—27 to 37 inches, pale brown (10YR 6/3) very gravelly loamy sand, brown (10YR 4/3) moist; massive, soft, very friable, nonsticky and nonplastic; few very fine roots; many fine interstitial pores; slightly acid; abrupt, wavy boundary.

C3—37 to 60 inches, brown (10YR 5/3) very cobbly sand, brown and very dark brown (10YR 4/3, 2/2) moist; single grain; loose (dry and moist), nonsticky and nonplastic; many fine interstitial pores; slightly acid.

The A horizon ranges from 7 to 15 inches in thickness and from grayish brown to pale brown in color. The C horizon ranges from grayish brown or brown to pale brown or light yellowish brown in color, from stratified loamy sand to very cobbly sand in texture, and from neutral to medium acid in reaction. Below a depth of 36 to 60 inches, this horizon is stratified sand, very gravelly sand, and very cobbly sand. This soil contains more gravel and cobblestones than Tujunga soils recognized elsewhere in California.

Tujunga soils generally are near areas of Anderson, Churn, and Reiff soils and of Cobbly alluvial land and Riverwash.

Tujunga loamy sand, 0 to 3 percent slopes (TfA).—This soil has the profile described as representative for the series. Permeability is rapid. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 3 to 4 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of Reiff soils and areas of Riverwash and Cobbly alluvial land.

This Tujunga soil is used as irrigated pasture. Small areas are used for other irrigated crops. Capability unit IVs–4(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Tujunga loamy sand, 3 to 8 percent slopes (TfB).—This soil has rapid permeability. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 3 to 4 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of Reiff soils and areas of Cobbly alluvial land and Riverwash.

This Tujunga soil is used as irrigated pasture. Small areas are used for other irrigated crops. Capability unit IVs–4(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Tuscan Series

The Tuscan series consists of well-drained soils that have a hardpan. These soils formed in old basic alluvium. They are on high terraces in the foothills of the eastern part of the survey area from Coleman Reservoir to Swede Creek Plains. Slopes are 0 to 8 percent. Elevation ranges from 700 to 1,000 feet. The annual precipitation is 30 to 40 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 225 to 275 days, and the 28° F. growing season is 300 to 340 days. The vegetation is annual grasses and forbs and scattered blue oak.

In a representative profile the surface layer is brown, strongly acid cobbly loam about 3 inches thick. The subsoil is reddish-brown, medium acid cobbly clay loam that extends to a depth of about 16 inches. Below the subsoil is an indurated hardpan about 10 inches thick. Below the hardpan is semiconsolidated, gravelly and cobbly alluvium.

The areas of Tuscan soils are used as dryland pasture.

Representative profile of Tuscan cobbly loam, 0 to 3 percent slopes, about 2½ miles west of Coleman Reservoir, 200 feet southeast of the northwest corner of sec. 36, T. 30 N., R. 3 W.:

A1—0 to 3 inches, brown (7.5YR 5/4) cobbly loam, dark reddish brown (5YR 3/3) moist; moderate, fine,

granular structure; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine interstitial pores; strongly acid; clear, smooth boundary.

B1—3 to 10 inches, reddish-brown (5YR 4/4) cobbly light clay loam, dark reddish brown (5YR 3/4) moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine interstitial pores and common very fine tubular pores; few thin clay films as bridges; medium acid; gradual, smooth boundary.

B2t—10 to 16 inches, reddish-brown (5YR 4/4) cobbly heavy clay loam, dark reddish brown (5YR 3/4) moist; massive; hard, friable, slightly sticky and plastic; few very fine roots; many very fine interstitial pores and common very fine tubular pores; common thin clay films as bridges; medium acid; abrupt, wavy boundary.

C1m—16 to 26 inches, indurated hardpan; common moderately thick clay films along fracture planes; diffuse, irregular boundary.

IIC2—26 to 60 inches, semiconsolidated gravelly and cobbly alluvium.

The A horizon ranges from 1 to 7 inches in thickness and from medium acid to strongly acid in reaction. The B2t horizon ranges from 6 to 20 inches in thickness, from dark red to reddish brown in color, from gravelly heavy clay loam to cobbly light clay in texture, and from neutral to medium acid in reaction. The indurated C horizon is at a depth of 8 to 20 inches. All of these soils are cobbly.

Tuscan soils generally are near areas of Guenoc, Igo, Inks, Keefers, Supan, and Toomes soils.

Tuscan cobbly loam, 0 to 3 percent slopes (ThA).—This soil has the profile described as representative for the series. Permeability is very slow. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 1 to 3.5 inches. The hardpan is at a depth of 8 to 20 inches.

Included with this soil in mapping were small areas of Igo and Keefers soils.

This Tuscan soil is used as dryland pasture, and a few areas are used as irrigated pasture. Capability unit IVs–8 (17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Tuscan cobbly loam, 3 to 8 percent slopes (ThB).—This soil has very slow permeability. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 1 to 3.5 inches. The hardpan is at a depth of 8 to 20 inches.

Included with this soil in mapping were areas of Igo and Keefers soils.

This Tuscan soil is used as dryland pasture. Capability unit IVe–8(17, 18); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Vina Series

The Vina series consists of well drained and moderately well drained soils that formed in dominantly basic alluvium. These soils are on low terraces and flood plains along the streams that drain the eastern part of the survey area. Slopes are 0 to 8 percent. Elevation ranges from 400 to 1,500 feet. The annual precipitation is 25 to 40 inches, and the average annual air temperature is about 64° F. The 32° F. growing season is 200 to 225 days, and the 28° F. growing season is 250 to 325 days. The vegetation is valley oak, interior live oak, blue oak, annual grasses, and Digger pine.

In a representative profile the surface layer is grayish-brown and brown, neutral and slightly acid loam about 34 inches thick. Below this layer, the substratum is yellowish-brown, slightly acid loam to a depth of more than 60 inches.

The areas of Vina soils are used for field crops.

Representative profile of Vina loam, 0 to 3 percent slopes, near Cow Creek, about 4½ miles northeast of Anderson, 800 feet east-southeast of the northwest corner of sec. 5, T. 30 N., R. 3 W.:

Ap1—0 to 3 inches, grayish-brown (10YR 5/2) loam, dark brown (10YR 3/3) moist; weak, thick, platy and moderate, medium, granular structure; slightly hard, friable, nonsticky and slightly plastic; many very fine and few fine roots; many very fine tubular and interstitial pores and few fine tubular pores; neutral; abrupt, smooth boundary.

Ap2—3 to 12 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak, coarse, prismatic structure; hard, friable, nonsticky and slightly plastic; common very fine and few fine roots; common very fine tubular and interstitial pores and few fine tubular pores; common burrows; slightly acid; clear, smooth boundary.

Ap3—12 to 24 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak, coarse, prismatic structure; hard, friable, nonsticky and slightly plastic; few fine and common very fine roots; common very fine tubular and interstitial pores and few fine tubular pores; weakly compacted; slightly acid; clear, smooth boundary.

A1—24 to 34 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; massive; hard, friable, nonsticky and slightly plastic; common very fine and few fine roots; many very fine tubular and interstitial pores and few fine tubular pores; common colloid stains in pores; few rodent burrows; slightly acid; clear, smooth boundary.

C1—34 to 49 inches, yellowish-brown (10YR 5/4) loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; common very fine roots; many very fine tubular and interstitial pores and few fine tubular pores; common collodial stains in pores; slightly acid; gradual, smooth boundary.

C2—49 to 63 inches, yellowish-brown (10YR 5/4) loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, nonsticky and slightly plastic; common very fine roots; many very fine tubular and interstitial pores and few fine tubular pores; few colloid stains; slightly acid.

The A horizon ranges from 12 to 36 inches in thickness, from dark brown or dark grayish brown to grayish brown or brown in color, from loam to gravelly loam in texture, and from neutral to medium acid in reaction. The C horizon ranges from grayish brown to light yellowish brown in color, from loam to gravelly loam in texture, and from neutral to slightly acid in reaction. A few areas of these soils are gravelly. Other areas are seeped, and they have darker mottled colors than the other soils in the series.

Vina soils generally are near areas of Hillgate, Inks, Los Robles, Molinos, Spreckels, and Supan soils.

Vina loam, 0 to 3 percent slopes (VeA).—This soil has the profile described as representative for the series. It is well drained. Permeability is moderate. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 9.5 to 11 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Honn, Los Robles, and Molinos soils and areas of Cobbly alluvial land.

This Vina soil is used for irrigated hay and as irrigated pasture. Small areas are used for other irrigated crops and for orchards. Capability unit I–1(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Vina loam, seeped, 0 to 3 percent slopes (VfA).—This soil is seeped and has a water table at a depth of about 3

to more than 5 feet. The substratum is mottled, but otherwise the profile is similar to that described as representative for the series. This soil is moderately well drained. Permeability is moderate. Water ponds on the surface, and erosion is not a hazard. Available water capacity is 9.5 to 11 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were small areas of Honn, Los Robles, and Molinos soils and areas of other Vina soils.

This Vina soil is used for irrigated hay and as irrigated pasture. Small areas are used for other irrigated crops and for orchards. Capability unit IIw-2(17, 22); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Vina gravelly loam, 3 to 8 percent slopes (VgB).—This soil has a profile similar to the one described as representative for the series, except that the content of gravel is 15 to 30 percent throughout the profile. This soil is well drained. Permeability is moderate. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 6 to 8 inches. Roots can penetrate to a depth of more than 60 inches.

Included with this soil in mapping were areas of Honn, Los Robles, and Molinos soils.

This Vina soil is used for irrigated and dryland hay and as irrigated pasture. Small areas are used as dryland pasture. Capability unit IIe-1(17, 18); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Wet Alluvial Land

Wet alluvial land (Wa) is somewhat poorly drained or poorly drained, is dark colored, and is loamy or clayey. It is nearly level to gently sloping and is in drainageways and basins in the central part of the survey area, mainly on terraces southeast of Anderson. Elevation ranges from 400 to 500 feet. The annual precipitation is about 25 inches, and the average annual air temperature is about 62° F. The 32° F. growing season is 200 to 250 days, and the 28° F. growing season is 300 to 325 days. The vegetation is sedges, wiregrass, cattail, and willows.

Permeability is slow. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 6 to 9 inches. Roots can penetrate to a depth of 36 to 48 inches.

Wet alluvial land generally is near areas of Perkins, Churn, Reiff, and Moda soils.

This land type is used as pasture. The quality of forage is poor and consists mainly of rushes and sedges. In places production can be improved by careful irrigation management of adjoining fields and by improving surface drainage. Capability unit IIIw-5(17); range site, not assigned; woodland suitability group, not assigned; wildlife group 2.

Windy Series

The Windy series consists of well-drained soils that are underlain by basic volcanic rock. These soils are on uplands in the eastern part of the survey area from Viola to Latour State Forest and Hatchet Mountain. Slopes range from 0 to 75 percent. Elevation ranges from 4,000 to 7,000 feet. The annual precipitation is 40 to 50 inches, and the average annual air temperature is about 44° F. The 32° F. growing season is 100 to 150 days, and the 28° F. growing season is 150 to 175 days. The vegetation is mixed conifers and brush.

In a representative profile the surface layer is very dark grayish-brown, strongly acid stony sandy loam and loamy sand about 8 inches thick. It is underlain by brown, very strongly acid sandy loam about 6 inches thick. The subsoil is light yellowish-brown, very strongly acid very gravelly sandy loam about 34 inches thick. Basic volcanic rock is at a depth of about 48 inches.

The areas of windy soils are used as woodland (fig. 8) and wildlife habitat and for watershed.

Representative profile of Windy stony sandy loam in an area of Windy and McCarthy stony sandy loams, 0 to 30 percent slopes, in Latour State Forest about 2 miles northwest of McMullen Mountain in E1/4 sec. 3, T. 32 N., R. 2 E.:

A11—0 to 4 inches, very dark grayish-brown (10YR 3/2) stony sandy loam, black (10YR 2/1) moist; strong, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; many very fine interstitial pores; much charcoal; strongly acid; clear, smooth boundary.

A12—4 to 8 inches, very dark grayish-brown (10YR 3/2) loamy sand, very dark brown (10YR 2/2) moist; moderate, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many fine roots; many fine interstitial pores; strongly acid; clear, wavy boundary.

A3—8 to 14 inches, brown (10YR 5/3) sandy loam, very dark brown (10YR 2/3) moist; moderate, very fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; very strongly acid; gradual, smooth boundary.

B21—14 to 30 inches, light yellowish-brown (10YR 6/4) very gravelly sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; few coarse roots; many very fine interstitial pores and common very fine tubular pores; very strongly acid; discontinuous, gradual, and broken boundary.

B22—30 to 48 inches, light yellowish-brown (10YR 6/4) very gravelly sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable, nonsticky and nonplastic; few coarse roots; many very fine interstitial pores and common very fine tubular pores; very strongly acid; discontinuous, broken boundary.

R—48 inches, basic volcanic rock.

The A horizon ranges from 10 to 20 inches in thickness, from very dark grayish brown to brown in color, from stony to very stony sandy loam or loam in texture, and from slightly acid to very strongly acid in reaction. The B horizon ranges from 20 to 40 inches in thickness, from light yellowish brown to very pale brown in color, from very gravelly sandy loam to loam in texture, and from medium acid to very strongly acid in reaction. Basic volcanic rock is at a depth of 40 to 60 inches. All areas of this soil are stony or very stony.

Windy soils generally are near areas of Jiggs, Lyonsville, and McCarthy soils. They are mapped in this survey area only in undifferentiated groups or complexes with McCarthy and Nanny soils.

Windy and McCarthy stony sandy loams, 0 to 30 percent slopes (WeD).—This unit is made up of Windy and McCarthy soils in about equal proportions. Windy stony sandy loam has north-facing and east-facing slopes, and McCarthy stony sandy loam has south-facing and west-facing slopes. Small areas of shallower soils were included in mapping.

The Windy soil has the profile described as representative for the Windy series. Permeability is rapid. Available water capacity is 5 to 7 inches.

Figure 8.—Profile of Windy stony sandy loam, 0 to 30 percent slopes, in a wooded area.

The McCarthy soil has a profile similar to the one described as representative for the McCarthy series. It has moderately rapid permeability. Available water capacity is 4 to 6 inches.

Runoff is medium to rapid on the soils of this unit. The hazard of erosion is moderate to high. Bedrock is at a depth of 40 to 60 inches. Stones cover 1 to 3 percent of the surface.

The areas of these soils are used as woodland and wildlife habitat and for watershed. Capability unit VIe-1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Windy and McCarthy very stony sandy loams, 30 to 50 percent slopes (WfE).—This unit is made up of Windy and McCarthy soils in about equal proportions. Windy very stony sandy loam has north-facing and east-facing slopes, and McCarthy very stony sandy loam has south-facing and west-facing slopes. Included in mapping were small areas of shallower soils. The Windy and the McCarthy soil each has a profile similar to that described as representative for its respective series.

The Windy soil has rapid permeability, and its available water capacity is 5 to 7 inches.

The McCarthy soil has moderately rapid permeability, and its available water capacity is 4 to 6 inches.

Runoff is rapid on the soils of this unit. The hazard of erosion is high. Bedrock is at a depth of 40 to 60 inches. Stones cover 3 to 10 percent of the surface.

The areas of these soils are used as woodland and wildlife habitat and for watershed. Capability unit VIs-1(22); range site, not assigned; woodland suitability group 5; wildlife group 8.

Windy and McCarthy very stony sandy loams, 50 to 75 percent slopes (WfG).—This unit is made up of Windy and McCarthy soils in about equal proportions. Windy very stony sandy loam has north-facing and east-facing slopes, and McCarthy very stony sandy loam has south-facing and west-facing slopes. Included in mapping were small areas of shallower soils. The Windy and the McCarthy soil each has a profile similar to the one described as representative for its respective series.

The Windy soil has rapid permeability, and its available water capacity is 5 to 7 inches.

The McCarthy soil has moderately rapid permeability, and its available water capacity is 4 to 6 inches.

Runoff is very rapid on the soils of this unit. The hazard of erosion is very high. Bedrock is at a depth of 40 to 60 inches. Stones cover 3 to 10 percent of the surface.

The areas of these soils are used as woodland and wildlife habitat and for watershed. Capability unit VIIs-1(22); range site, not assigned; woodland suitability group 6; wildlife group 6.

Windy and McCarthy very rocky sandy loams, 8 to 50 percent slopes (WgE).—This unit is made up of Windy and McCarthy soils in about equal proportions. Windy stony sandy loam has north-facing and east-facing slopes, and McCarthy stony sandy loam has south-facing and west-facing slopes. Included in mapping were areas of shallower soils. The Windy and the McCarthy soil each has a profile similar to that described as representative for its respective series.

The Windy soil has rapid permeability, and its available water capacity is 5 to 7 inches.

The McCarthy soil has moderately rapid permeability, and its available water capacity is 4 to 6 inches.

Runoff is medium to rapid on the soils of this unit. The hazard of erosion is moderate to high. Bedrock is at a depth of 40 to 60 inches. Stones cover 1 to 3 percent of the surface. Exposed bedrock outcrops cover 10 to 25 percent of the surface.

The areas of these soils are used as woodland and wild-

490-726—74——6

life habitat and for watershed. Capability unit VIs 1(22); range site, not assigned; woodland suitability group 7; wildlife group 4.

Use and Management of the Soils

This section discusses use and management of the soils for crops and pasture and gives facts about use of the soils for range. It also discusses woodland use and use of the soils for wildlife habitat. Finally, it gives engineering facts about the soils.

Use of the Soils for Crops and Pasture

Soils of the Shasta County Area are used extensively for irrigated alfalfa grown for hay, irrigated pasture, and dryland pasture. They are also used to grow corn for silage, barley, wheat, strawberry plants, and olives, prunes, walnuts, and a number of other kinds of fruits and nuts. In the following pages, the system of capability grouping used by the Soil Conservation Service is explained, the land resource areas are described, and management of major crops is discussed. Then the Storie index ratings are defined, and the estimated average acre yields of irrigated alfalfa, irrigated pasture, and dryland pasture are given.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for woodland, or for engineering.

In the capability system, the kinds of soil are grouped at three levels: The capability class, the subclass, and the unit. These are discussed in the following paragraphs.

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils (none in Shasta County Area) are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; *c*, used in only some parts of the United States, but not in this survey area, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils.

In capability classes I through IV, capability units in California are given Arabic numbers that suggest the chief kind of limitation responsible for placement of the soil in the capability class and subclass. For this reason, some of the units within the subclasses are not numbered consecutively, and their symbols are a partial key to some of the soil features. Except for class I, the numerals used to designate units within the classes and subclasses are:

0. A problem or a limitation caused by sand and gravel in the substratum that limits the penetration of roots.
1. An erosion hazard, actual or potential.
2. A problem or limitation of wetness caused by poor drainage or flooding.
3. A problem or limitation caused by slow or very slow permeability of the subsoil or substratum.
4. A problem or limitation caused by coarse texture or excessive gravel.
5. A problem or limitation caused by a fine-textured or very fine textured surface layer.

6. A problem or limitation caused by salt or alkali (not used in this survey area).
7. A problem or limitation caused by cobblestones, stones, or rock outcrops.
8. A problem or limitation caused by nearly impervious bedrock or hardpan within the effective rooting depth.
9. A problem or limitation caused by low fertility or by toxicity.

Soils in classes V through VIII are given the single, nonconnotative Arabic number 1. The management, plant composition, and yields where these soils are used for range or for trees are given in the sections "Use of the Soils for Range" and "Woodland Uses of the Soils," respectively.

Land resource areas

The Shasta County Area is in parts of four land resource areas because of the variety in climate, topography, vegetation, and land use. These areas are designated nationally as 15, 17, 18, and 22. Land resource area 15 consists of foothills in the western part of the Shasta County Area; 17, the upper part of the Sacramento Valley; 18, the eastern foothills; and 22, the forested mountainous uplands. Soils in two or more resource areas can be similar and have the same capability unit symbol but have different requirements for management.

Capability units in the several resource areas are identified by a capability unit symbol, followed by a number, or numbers, in parentheses. For example, capability unit IVe–8(22) and the capability units originally numbered IVe–8(17) and IVe–8(18) consist of well-drained soils that are shallow to moderately deep over bedrock or hardpan. The unit originally numbered IVe–8(17) consists of soils in the irrigated valley; the unit originally numbered IVe–8(18) consists of soils on the oak-covered and grass-covered foothills; and unit IVe–8(22) consists of soils on the conifer-forested mountains. Where use and management are similar, soils that are in two or more resource areas but that have the same capability symbol were combined in one capability unit. Capability units originally numbered IVe–8(17) and IVe–8(18), for example, were combined in capability unit IVe–8(17, 18). The land resource areas are described in the following paragraphs.

Land resource area 15 is called the Central California Coast Range. This resource area includes the Bald Hills and surrounding areas from the Igo-Platina road southward to Cottonwood Creek. The soils are gently sloping to steep but are mostly rolling to hilly. Elevation ranges from 600 to 2,000 feet, and the annual rainfall is 30 to 40 inches. The frost-free season is 200 to 250 days. On the gently sloping soils, the vegetation is that of an open grassland, and oaks and shrubs are along streams. On the steeper soils, shrubs and trees are more abundant and there is less grass. Grazing is the main farm use. Only a small part of this land resource area is irrigated, and there is little opportunity for developing sources of water.

Land resource area 17 is called the Sacramento and San Joaquin Valleys. This resource area includes the Sacramento Valley, small tributary valleys, and terraces flanking these valleys. The soils generally are nearly level, except along some dissected terrace fronts. Most of the soils along these terrace fronts are steep. Elevation ranges from 350 to 900 feet, and the annual rainfall is 25 to 50 inches. Most rainfall occurs in winter, and summer is hot and dry. In this resource area, irrigation water is available or a source is being developed for most soils that are suitable for irrigation. The frost-free season is 250 to 300 days. Vegetation was formerly grasses, shrubs, and trees, but most of the soils have been cleared and are used for cultivated crops. Nearly all the cropland in the Shasta County Area is in this land resource area.

Land resource area 18 is called the Sierra Nevada Foothills. This resource area is in the foothills of the Cascade Range east of the Sacramento Valley, and it extends around and above the valley terraces. Most of the streams flow southwestward. The soils are mainly rolling to hilly, but they are steep at the higher elevations and are gently sloping in areas near the Sacramento Valley. Elevation ranges from 500 to 2,000 feet. The annual rainfall is 30 to 50 inches, and the frost-free season is 200 to 250 days. Vegetation is oaks, Digger pines, shrubs, and grasses. Grazing is the most common use. Only a small part of this area is irrigated, and there is little opportunity for expanding irrigation.

Land resource area 22 is called the Sierra Nevada Range. This area includes the forested mountains that enclose the survey area on the northwest, north, and east. The soils on the upland lava plateaus of the Cascade Range are gently sloping, and those in the canyons of the Klamath Mountains are steep or very steep. A few narrow mountain valleys are present, and some meadows occur where water collects. Elevation ranges from 2,500 to 7,000 feet. The annual rainfall is 40 to 60 inches, but only about 2 inches falls in summer. The frost-free season is 90 to 150 days. Higher elevations have a cover of snow in winter. Lumbering is the principal industry, but recreation is increasing in importance. Beef cattle are raised in open areas and in natural meadows. These meadows, a few orchards, and pastures are the only areas that are irrigated. There is little opportunity to expand irrigation.

Management by capability units

In the following pages, the capability units of the survey area are described, and management for the soils in these units is suggested. The mention of the soil series in these descriptions does not mean that all the soils in the series are in the capability unit. To determine the soils in each unit, refer to the "Guide to Mapping Units" at the back of this survey. Additional facts about the soils are given in the section "Descriptions of the Soils."

CAPABILITY UNIT I–1(17)

This unit consists of well-drained soils of the Churn, Honcut, Honn, Los Robles, Molinos, Reiff, and Vina series. These soils formed in alluvium from mixed rock sources. They are on valley bottoms and stream terraces. Slopes are 0 to 2 percent. The surface layer ranges from fine sandy loam to loam.

Permeability is moderately slow to moderately rapid in the soils of this unit. Roots can penetrate to a depth of 60 inches or more. Available water capacity is 7.5 to 12 inches. Runoff is very slow, and the hazard of erosion is none to slight. These soils are easy to work.

These soils are among the most productive in the survey area, and they are suited to all climatically adapted crops. These soils are suited to row crops, orchard crops, small grains, pasture, and hay.

Crops grown on these soils respond readily to applications of fertilizer. Most crops need applications of nitrogen fertilizer, but alfalfa and other legumes respond to applications of phosphorus and sulfur fertilizer. In places prune trees need fertilizer that contains nitrogen and potassium. Intensive use of these soils often results in depletion of organic-matter content and in poor tilth. The organic-matter content can be improved by returning crop residue or green-manure crops to the soil and by using a suitable crop rotation. Green-manure crops that are planted in fall are beneficial to the soils. If soils are used for row crops, a green-manure crop can be grown each year, but it should be grown at least every 3 to 5 years.

If these soils are used for irrigated pasture, the quality of forage can be maintained by dividing pastures into several units and grazing the units in rotation to permit regrowth of the plants. This practice allows the soils to dry before grazing begins and thus reduces soil compaction.

All methods of irrigation are suitable for these soils. The frequency of irrigation and the quantity of water used depend upon the crop grown, the season, and the available water capacity of the soil. For a few soils near streams, additional water is available as the result of subirrigation. This moisture in the substratum is at a depth of about 10 to 12 feet; consequently, deep-rooted tree crops need less irrigation than do those in other areas. Subirrigation occurs in a few areas of the Reiff, Vina, and Molinos soils.

Unless extremely deep cuts are made, leveling or grading causes no permanent damage to these soils. Formation of a tillage pan can be controlled by avoiding excess cultivation and by keeping machinery and livestock off these soils when they are wet. Formation of a tillage pan can be avoided in orchards by eliminating tillage, chopping the cover crop, and using sprinkler irrigation. A pan that has already formed in an orchard can be broken by chiseling. A pan that has formed in an open field can be broken by subsoiling and chiseling.

CAPABILITY UNIT IIe-1(17, 18)

This unit consists of well-drained soils of the Churn, Honn, Los Robles, Reiff, Sierra, and Vina series. These soils formed in alluvium from mixed rock sources or in material weathered from granite. They are on alluvial fans and terraces or on the toe slopes of foothills. Slopes are 3 to 8 percent. The surface layer ranges from fine sandy loam to loam or gravelly loam.

Permeability is moderately slow to moderately rapid in the soils of this unit. Roots can penetrate to a depth of 40 to more than 60 inches. Available water capacity is 6.5 to 12 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate. These soils are easy to work, but the gravelly soils are more difficult to till than the nongravelly soils.

These soils are used mainly for irrigated hay, pasture, row crops, and orchards, but a few areas are used for dryland hay, grain, and pasture, or as range. If these soils are irrigated, they are suited to all climatically adapted crops.

The organic-matter content and productivity can be maintained by using nitrogen fertilizer and, in places, phosphorus fertilizer; returning crop residue or green-manure crops to the soil; or using a suitable crop rotation.

Irrigating on the contour on gently sloping areas and using sprinklers on steeper slopes are ways of helping to control erosion. These methods of irrigation allow time for the water to enter the soil and to wet it more uniformly. A system for collecting excess irrigation water for safe disposal is needed in places. Among the practices that help to control sheet erosion in grain fields are tillage across the slope, stubble mulching, and use of a cover crop.

Deep cuts generally can be made when leveling, and irregularities of slope can be smoothed without causing permanent damage to the soil.

The soils in this unit are easy to work, but they tend to form a tillage pan. Minimum tillage helps to slow the formation of these pans. The pans can be broken by chiseling or subsoiling.

CAPABILITY UNIT IIe-1(22)

Aiken loam, 0 to 8 percent slopes, is the only soil in this unit. It is a well-drained soil that formed in material weathered from volcanic rock on broad ridges.

Permeability is moderately slow in the subsoil. Roots can penetrate to a depth of more than 60 inches. Available water capacity is 9 to 11 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil is easy to work.

This soil is well adapted to timber production, and it is profitable to keep the soil in this use. The gentle slopes of this soil are favorable for intensive management, such as pruning, thinning, and controlling fires, insects, and diseases. The production of timber can be increased by using these management practices. No special methods of harvesting the timber are needed on this soil.

If this soil is cleared and irrigation water is available, it is suited to irrigated pasture and to orchards of deciduous fruit trees. These crops generally respond well to applications of nitrogen and phosphorus fertilizer. Pine seedlings are difficult to control in a few cultivated areas. Sheet erosion in these areas can be controlled by growing a cover crop, tilling across the slope, and similar practices. In places diversion ditches are needed to remove excess water.

CAPABILITY UNIT IIe-3(17)

This unit consists of well-drained soils of the Churn, Perkins, and Tehama series. These soils formed in alluvium from mixed rock sources. They are on terraces. Slopes are 3 to 8 percent. The surface layer is loam or gravelly loam.

Permeability is moderately slow to slow in the subsoil. Roots can penetrate to a depth of 36 to more than 60 inches. The rooting depth is limited by a weakly cemented substratum or by unrelated sandstone or shale in places. Available water capacity is 5 to 12 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

These soils are better suited to shallow-rooted trees in irrigated orchards and to shallow-rooted field crops and pasture plants than to deep-rooted plants. They are also suited to dryland hay, small grain, and pasture.

Most irrigated crops respond to applications of nitrogen and phosphorus fertilizer. The content of organic matter is naturally low, and increasing the supply is difficult under dryland farming. Where the soils are irrigated, properly managing crop residue, growing green-manure crops, and using a suitable crop rotation help to maintain a favorable supply of organic matter.

Erosion is a hazard on these soils if they are irrigated. Sprinkler irrigation is an efficient means of applying irrigation water on most of these soils, but irrigating on the contour is suitable on the gently sloping soils. In places a system for safely disposing of excess irrigation water is needed if furrow irrigation on the contour is used. Applying irrigation water at a slow rate allows nearly all the water to enter the soil and helps to control erosion by reducing runoff. Water enters the subsoil of these soils at a slow to moderately slow rate, so it is seldom practical to wet more than the upper part of the soil. This method reduces the available water capacity of these soils, so that frequent applications of water in small amounts are needed, especially in warm months. Sheet erosion in grain and hay fields can be controlled by tillage across the slope, stubble mulching, use of a cover crop, and similar practices that are easy to apply.

CAPABILITY UNIT IIe-5(17)

Myers silty clay, 3 to 8 percent slopes, is the only soil in this unit. It is a moderately well drained soil that formed in alluvium from sandstone and shale on terraces.

Permeability is slow in this soil. Roots can penetrate to a depth of more than 60 inches. Available water capacity is 9 to 11 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

This soil is used for and suited to a wide variety of crops. Because of its silty clay texture and slow permeability, this soil is not so well suited to tree crops as the more permeable, coarser textured soils.

When this soil is dry, it cracks and takes in water rapidly. After it becomes wet, the cracks seal, and the soil takes in water slowly. This soil must be worked at the proper moisture content. If tilled when it is too dry, large, hard clods form; if tilled when it is too wet, it seals over and becomes puddled.

Fertility can be improved by applying nitrogen fertilizer, returning crop residue or green-manure crops to the soil, or using legumes or other soil-improving crops in the crop rotation. Tillage across the slope helps to reduce runoff and to control erosion.

CAPABILITY UNIT IIw-2(17, 22)

This unit consists of moderately well drained soils of the Churn, Los Robles, Molinos, Perkins, Reiff, and Vina series and of poorly drained soils of the Shingletown series. These soils formed in alluvium from volcanic or sedimentary rock sources. All these soils except Shingletown soils are in narrow valleys along streams. Shingletown soils occupy higher positions. Slopes are 0 to 3 percent. These soils either are seeped with water from higher lying soils, or they have a perched water table for short periods. The surface layer ranges from fine sandy loam to loam or gravelly loam.

Permeability is slow to moderately rapid in the soils of this unit. Roots can penetrate to a depth of more than 60 inches. Available water capacity is 5 to 12 inches. Runoff is very slow on these soils, or water ponds on the surface. The hazard of erosion is none to slight. These soils generally are easy to work, but the gravelly soils are somewhat more difficult to work.

The soils in this unit are used for irrigated hay and pasture, irrigated row and field crops, and orchard crops, and for dryland hay and pasture. Because of the wetness of their subsoil, they are better suited to shallow-rooted crops than to deep-rooted crops. Shingletown soils are suited to pasture, hay, and small grain.

Improvement of drainage generally is not practical, because of the size and shape of the areas and the lack of suitable drainage outlets. Wetness can be controlled in some fields, however, by avoiding overirrigation. Grading these soils to eliminate low spots also helps to improve drainage. Grading cuts can be deep without exposing infertile subsoil. If subirrigation is used on these soils, a few crops can be successfully grown without the need for other methods of irrigation or with only supplemental irrigation late in summer.

Tillage pans are common in these soils, but their formation can be controlled by cultivating late in spring after the surface soil dries. Tillage pans can be broken by chiseling in summer or fall when the soils are dry. Legumes and most other crops grown on these soils respond well to applications of nitrogen fertilizer. Productivity can be maintained by growing a green-manure crop, turning under crop residue, and using crop rotations, along with fertilization.

CAPABILITY UNIT IIs-0(17)

This unit consists of well-drained soils of the Honcut and Reiff series. These soils formed in alluvium from mainly basic rocks. They are on alluvial fans and valley bottoms. Slopes range from 0 to 3 percent. The surface layer is fine sandy loam or gravelly loam that is underlain, at a depth of 40 to 60 inches, by very gravelly sand to very gravelly loam.

Permeability is very rapid in the substratum. Available water capacity is 6 to 9 inches. Runoff is very slow, and the hazard of erosion is none to slight. These soils are easy to work.

These soils are used for and are suited to a wide variety of crops, such as irrigated row crops, orchard crops, pasture, and hay. They are also used for dryland pasture.

Careful leveling or smoothing is needed on these soils to avoid exposing the very gravelly substratum. If excessive losses of water and plant nutrients through deep leaching are to be avoided, irrigation water and fertilizer should be applied more frequently and in smaller amounts than for soils that have a less permeable substratum. If these soils are furrow or border irrigated, the runs should be short to avoid water losses. Most crops grown on these soils respond well to applications of nitrogen and phosphorus fertilizer. Returning crop residue, green-manure crops, or cover crops to the soil helps to improve soil structure and fertility and to increase the content of organic matter.

CAPABILITY UNIT IIs-3(17)

This unit consists of well drained and moderately well drained soils of the Churn, Perkins, and Tehama series. These soils formed in alluvium from mostly sedimentary rock on old terraces. Slopes are 0 to 3 percent. The surface layer is gravelly loam or loam.

Permeability is moderately slow to slow in the soils of this unit. Roots can penetrate to a depth of 36 to 60 inches. Available water capacity is 5 to 12 inches. Runoff is slow to very slow, and the hazard of erosion is none to slight.

These soils are better suited to irrigated pasture, field

crops, shallow-rooted crops, and orchard trees than to other crops. They are also suited to dryland grain and hay.

Most crops grown on these soils respond well to applications of nitrogen and phosphorus fertilizer. In places where these soils are cropped intensively, potassium fertilizer is needed for high yields of such crops as prunes. The production of crops can be increased by using crop residue, growing green-manure crops in the orchards, and using a suitable crop rotation. The maximum production of forage can be obtained from irrigated pastures by grazing fields in rotation and by fertilizing. These management practices also help to improve soil tilth.

All methods of irrigation are suitable for these soils. Applying irrigation water in small amounts and using long runs allows time for the water to enter the soil. A system for the disposal of excess irrigation water is needed in places. Such a system may need to be joined to a community drainage system. Cuts made when leveling or grading should be shallow to avoid exposing the less fertile and clayey subsoil. In irrigated pastures the trampling of wet soil by livestock tends to reduce the intake of water in the soils, and rotation grazing is beneficial.

CAPABILITY UNIT IIs-4(17)

This unit consists of well-drained soils of the Churn, Honcut, Honn, Los Robles, and Reiff series. These soils formed in alluvium from mixed rock sources. Slopes are 0 to 3 percent. The surface layer is gravelly loam or gravelly sandy loam.

Permeability is moderately rapid to moderately slow in the soils of this unit. Roots can penetrate to a depth of more than 60 inches. Available water capacity is 6 to 10 inches. Runoff is very slow and water is ponded in a few places. The hazard of erosion is none to slight.

These soils are suited to a variety of crops, such as irrigated orchard crops, row crops, and field crops. If these soils are carefully irrigated, deep-rooted crops are well suited, and shallow-rooted crops also can be successfully grown. A few areas are used for dryland pasture.

Smaller and more frequent applications of irrigation water are needed on shallow-rooted crops than on deep-rooted crops. Short irrigation runs are favorable because the soils take in water rapidly. Irrigation systems are more difficult to design in places where these gravelly soils are in areas with less permeable soils, such as the Moda soils.

The content of organic matter is naturally low in these soils, but it can be increased by growing green-manure crops, turning under crop residue, and using a suitable crop rotation. Most crops grown on these soils respond well to applications of nitrogen and phosphorus fertilizer, and a few crops respond favorably to applications of potassium, especially at more intensive levels of management.

CAPABILITY UNIT IIs-5(17)

Myers silty clay, 0 to 3 percent slopes, is the only soil in this unit. It is a well-drained soil that formed in alluvium from sedimentary material.

Permeability is slow in this soil. Roots can penetrate to a depth of more than 60 inches. Available water capacity is 9 to 11 inches. Runoff is very slow, and the hazard of erosion is none to slight.

This soil is used for and suited to irrigated and dryland pasture and hay. It is also used for other irrigated crops adapted to the area, but deep-rooted crops and most tree crops are not well suited because of slow permeability.

When this soil is dry, it cracks and takes in water rapidly. After it becomes wet, the cracks seal and the soil takes in water slowly. This soil must be worked at the proper moisture content. If tilled when it is too dry, large clods form; if tilled when it is too wet, it seals over.

Irrigation water is best applied by using sprinklers or carefully controlled borders or furrows. Returning crop residue, manure, green-manure crops, cover crops, or other organic matter to the soil helps to improve soil fertility and structure. Most crops grown on this soil respond well to applications of nitrogen fertilizer, and legumes respond favorably to applications of phosphorus.

CAPABILITY UNIT IIIe-1(17, 18)

This unit consists of well drained and moderately well drained soils of the Auberry, Los Robles, and Sierra series. These soils formed in material weathered from decomposed granite or in alluvium from basic rock. Slopes are 0 to 15 percent. The surface layer ranges from sandy loam to loam.

Permeability is moderate to moderately slow in the soils of this unit. Roots can penetrate to a depth of 24 to more than 60 inches. Available water capacity is 4 to 12 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

These soils are used mainly for dryland or irrigated pasture and as range. These soils are suited to dryland or irrigated hay and small grain and, to a lesser extent, to irrigated crops grown in the survey area.

The production and quality of forage can be increased by clearing brush and planting and fertilizing adapted forage plants. Grazing needs to be controlled to maintain desirable forage plants and to reduce the hazard of erosion.

Tillage across the slope or on the contour helps to reduce runoff and to control erosion. Returning crop residue, cover crops, or green-manure crops to the soil helps to improve fertility, the content of organic matter, and soil structure. Most crops grown on these soils respond well to applications of nitrogen and phosphorus fertilizer. A few pasture plants respond favorably to applications of sulfur.

If these soils are furrow irrigated, the furrows need to run across the slope or to be on the contour. If sprinklers are properly designed, they are an efficient means of applying irrigation water. Mechanical means of removing excess water from the surface are needed in places, and the length of slope needs to be reduced to help to control erosion.

CAPABILITY UNIT IIIe-1(22)

This unit consists of well-drained soils of the Aiken, Boomer, Cone, Nanny, Sites, and Windy series. These soils formed in material weathered from volcanic rock and greenstone. Slopes are 0 to 15 percent. The surface layer ranges from gravelly sandy loam to gravelly loam.

Permeability is rapid to moderately slow in the soils of this unit. Roots can penetrate to a depth of 40 to more than 60 inches. Available water capacity is 4 to 12 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

These soils are better suited to growing trees than to other purposes and are used mostly for timber production. They are among the most productive soils for timber in the area. If water is available at lower elevations, these soils are suited to irrigated pasture and to orchards.

The production of timber can be increased by using intensive management practices, such as pruning, thinning, and controlling fires, insects, and diseases. No special methods of harvesting timber are needed on these soils.

Sprinklers are a favorable means of applying irrigation water because of slope. Tillage and irrigation across the slope and use of cover crops in orchards help to control erosion. Fertilizer that contains nitrogen and phosphorus is needed. Conifer seedlings are difficult to control in places, but the pine seedlings on the Cone soils generally are less difficult to control. The climate of the survey area, the hazard of erosion, the expense of clearing, and a water shortage limit the use of most of these soils.

CAPABILITY UNIT IIIe-3(17, 22)

This unit consists of well-drained soils of the Keefers, Kilarc, Newtown, Perkins, Spreckels, and Tehama series. These soils formed in alluvium from a variety of rocks. They are on terraces. Slopes are 3 to 15 percent. The surface layer is sandy loam, loam, or gravelly loam.

Permeability is slow in the subsoil, and the Spreckels soils have a very slowly permeable hardpan below the subsoil. Roots generally can penetrate to a depth of 20 to more than 60 inches, but the depth of penetration is limited in places by weakly consolidated sediment, by sandstone or shale, or by a hardpan. Available water capacity is 3.5 to 12 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate. These soils are easy to work but are readily compacted if they are cultivated when too wet.

Kilarc soils are at higher elevations than the other soils in this unit, but Kilarc soils have similar uses and management needs.

These soils are better suited to such shallow-rooted crops as irrigated pasture and olive trees or dryland small grain, hay, and pasture than to deep-rooted crops.

The use of pasture plants and other close-growing crops helps to control erosion on steep slopes. On irrigated soils careful application of irrigation water on the contour or by sprinkling on the steeper slopes helps to control erosion. The use of a permanent grass cover that is mowed and sprinkler irrigated, using small quantities of water, is an effective means of controlling erosion in orchards. On soils used for dryland crops, cultivating and seeding across the slope, using cover crops and crop residue, and leaving grain stubble on the surface as a mulch in winter help to control erosion.

Most crops grown on these soils respond well to applications of nitrogen and phosphorus fertilizer. Growing crops in the rotation helps to promote good growth of crops. A favorable production of forage can be obtained in irrigated pasture by rotation grazing and by fertilizing.

CAPABILITY UNIT IIIe-5(15)

Sehorn silty clay, 3 to 8 percent slopes, is the only soil in this unit. It is a well-drained soil that formed in material weathered from sandstone or shale.

Permeability is slow in this soil. Roots can penetrate to a depth of 30 to 48 inches. Available water capacity is 5 to 9 inches. Runoff is slow, and the hazard of erosion is slight.

This soil is well suited to dryland small grain, hay, and pasture. If irrigation water is available, the gently sloping areas are suitable for irrigated crops and for pasture. Irrigating is hazardous on the moderately sloping areas unless sprinklers are used.

This soil cracks widely when it is dry, and the preparation of a seedbed is difficult in places.

Seeding on the contour and leaving stubble mixed in the surface soil helps to control erosion in grain fields. Special treatment is needed in a few fields to control gully erosion.

Production can be maintained by growing soil-improving crops in a rotation, using green-manure crops, and fertilizing. Most crops grown on this soil respond well to applications of nitrogen fertilizer.

CAPABILITY UNIT IIIe-8(18)

Supan gravelly loam, 5 to 15 percent slopes, is the only soil in this unit. It is a well-drained soil that formed in material weathered from tuff.

Permeability is moderately slow in the subsoil. Roots can penetrate to a depth of 20 to 40 inches. Available water capacity is 4 to 7 inches. Runoff is medium, and the hazard of erosion is moderate.

This soil is used mostly for grazing cattle. A few areas have been cleared and are used for irrigated pasture and cultivated crops. If irrigation water is available, this soil is better suited to the shallow-rooted deciduous trees or crops and to pasture than to deep-rooted crops.

In cultivated areas, growing a permanent sod cover in orchards, using sprinkler irrigation, and leaving straw and plant residue on the surface help to control erosion. Clean-cultivated crops need to be tilled on the contour or across the slope. Rotating cultivated crops with pasture and using green-manure crops and crop residue improves soil structure and fertility, which in turn makes the soil more resistant to erosion. On long irrigated slopes, diversion ditches are needed to intercept runoff. Crops grown on this soil respond well to applications of nitrogen and phosphorus fertilizer.

Irrigation water should be applied carefully to avoid saturating the soil. Sprinkler systems provide the proper control. On irrigated pasture, a system is likely to be needed to convey runoff water to a safe disposal area.

Grazing needs to be controlled on this soil. Under dryland conditions this soil responds favorably to seeding adapted forage plants and to fertilizing.

CAPABILITY UNIT IIIe-9(17)

This unit consists of well-drained and moderately well drained soils of the Red Bluff series. These soils formed in alluvium derived from mixed rock sources. They are on high terraces. Slopes are 3 to 8 percent. The surface layer is loam or gravelly loam.

Permeability is moderately slow or very slow in the soils of this unit. Roots can penetrate to a depth of 24 to 36 inches to consolidated alluvium or to more than 60 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

Most areas of Red Bluff soils are used for pasture or as range, but olive trees grow in a few areas. Because these soils are very low in fertility, they are suitable for such specialty crops as strawberry plants, from which the economic returns are adequate to justify the large amounts of fertilizer needed for good growth of crops.

Leveling the areas of these soils for flood irrigation is

not feasible, so sprinkler irrigation commonly is used. If nutrient deficiencies are overcome in these soils, they can produce satisfactory yields of a wide variety of irrigated crops. Growing dryland crops generally is uneconomical.

Because these soils have a somewhat lower available water capacity than most soils of similar texture, irrigation water must be applied frequently in small amounts. Tillage pans do not form readily in these soils. Consequently, these soils can be worked soon after an irrigation or rain, and some spraying operations and winter harvesting of such specialty crops as strawberry plants are not delayed.

CAPABILITY UNIT IIIw-5 (17)

This unit consists of soils of the Anita series and of the land type Wet alluvial land. These soils and this land type are somewhat poorly drained to poorly drained. They formed in material weathered from tuff or from mixed rock sources. Slopes are 0 to 5 percent. The surface layer ranges from loam to clay.

Permeability is slow in the soils of this unit. Roots can penetrate to a depth of 24 to more than 60 inches. Available water capacity is 4 to 9 inches. Runoff is very slow to medium and is ponded in some areas. The hazard of erosion is none to moderate. A water table is at a depth of 1 to more than 4 feet.

These soils are used for dryland pasture. If these soils are properly drained, they can be cultivated successfully. After drainage is established, they are best suited to irrigated pasture. The better drained areas of these soils are suited to a few orchard trees, such as prunes, or to dryland grain and hay.

Production can be increased by using a proper drainage system, fertilizer, crop rotations, green-manure crops, and crop residue. Most crops grown on these soils respond well to applications of nitrogen and phosphorus fertilizer.

CAPABILITY UNIT IIIs-0 (17)

This unit consists of well-drained and somewhat excessively drained soils of the Anderson and Reiff series. These soils formed in alluvium from mixed rock sources. Slopes are 0 to 3 percent. The surface layer is gravelly sandy loam or gravelly fine sandy loam, and the substratum is very gravelly sand.

Permeability is rapid to very rapid in the substratum of the soils in this unit. Available water capacity is 3.75 to 6.5 inches. Runoff is slow to very slow, and the hazard of erosion is none to slight.

These soils are better suited to irrigated orchard and to row and field crops than to dryland crops. They are too droughty to produce satisfactory yields without irrigation.

Sprinklers are an efficient means of applying irrigation water. Because the available water capacity is low in these soils, irrigation water should be applied frequently and in small amounts to avoid wasting water and leaching plant nutrients. Cuts made when leveling and grading these soils should be shallow to avoid exposing underlying gravels.

The productivity of these soils can be maintained by using green-manure crops, crop residue, and crop rotations. Most crops grown on these soils respond well to applications of nitrogen and phosphorus fertilizer. Fertilizer is more effective when applied in small amounts several times during the growing season before irrigating.

CAPABILITY UNIT IIIs-3 (17)

This unit consists of well-drained soils of the Anderson, Keefers, Moda, Perkins, and Spreckels series. These soils formed in alluvium from a variety of rock types. Most of the soils are on terraces. Slopes are 0 to 3 percent. The surface layer is sandy loam or loam that is gravelly in some areas.

Permeability is slow or very slow in the soils of this unit. Roots can penetrate to a depth of 20 to 42 inches to a hardpan or weakly cemented or consolidated sediment. Available water capacity is 3.5 to 7.5 inches. Runoff is very slow to slow, and the hazard of erosion is none to slight.

These soils are better suited to such shallow-rooted crops as irrigated pasture and olive trees and to such dryland crops as small grain, hay, and pasture than to other crops.

If these soils are irrigated, they tend to become waterlogged because of slow permeability and low available water capacity. This condition can be avoided by applying small quantities of water at frequent intervals. Very careful leveling and grading are needed to avoid exposing the clayey subsoil or the compact substratum. Generally, these soils can be graded so that excess surface water drains off, but a community-type drainage system is needed in places to adequately carry away this water.

Productivity can be maintained by using crop rotations, green-manure crops and crop residue and by fertilizing. Most crops grown on these soils respond well to applications of nitrogen and phosphorus fertilizer. In irrigated pasture, productivity can be maintained by rotation grazing and fertilization.

CAPABILITY UNIT IIIs-9 (17)

This unit consists of well drained and moderately well drained soils of the Red Bluff series. These soils formed in alluvium from mixed sources. Slopes are 0 to 3 percent.

Permeability is moderately slow or very slow. Roots can penetrate to a depth of 24 to 36 inches to consolidated alluvium or to more than 60 inches. Available water capacity is 3.5 to 10.5 inches. Runoff is very slow, and the hazard of erosion is none to slight.

Most areas of these soils are used for pasture or as range, but a few areas are used for growing olive trees. Because these soils have very low fertility, they are well adapted only to those cultivated crops that produce high enough returns to pay for large amounts of fertilizer. Such a specialty crop is strawberry plants for nursery stock. A few areas of these soils are used for irrigated pasture.

If the nutrient deficiencies in these soils are overcome, they are suitable for a wide variety of irrigated crops. Growing dryland crops generally is uneconomical.

Because these soils have a lower available water capacity than soils of similar texture, irrigation runs need to be short, and small amounts of irrigation water need to be applied at frequent intervals. Tillage pans do not form readily in these soils. Consequently, these soils can be worked soon after irrigation or rain, and some spraying operations and winter harvesting of such specialty crops as strawberry plants are not delayed. Leveling and grading must be done carefully to avoid exposing the less fertile subsoil.

CAPABILITY UNIT IVe-1 (18)

Sierra sandy loam, 15 to 30 percent slopes, is the only soil in this unit. It is well-drained soil that formed in material weathered from granitic rocks.

Permeability is moderately slow in this soil. Roots can penetrate to a depth of 40 to more than 60 inches. Available water capacity is 7 to 12 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is usd for dryland pasture and as range. It is marginally suited to such dryland crops as small grain and hay. The production of forage can be increased by clearing brush, reseeding, and fertilizing. Clearing should be done by chemical means rather than by mechanical means because of the hazard of erosion. Grazing needs to be carefully managed to avoid overgrazing which reduces the numbers of favorable plants and increases the hazard of erosion.

CAPABILITY UNIT IVe-1(22)

This unit consists of well-drained soils of the Aiken, Boomer, Cohasset, Cone, Forward, Josephine, and Sites series. These soils formed in material weathered from a variety of parent rocks. Slopes are 0 to 30 percent. The surface layer is sandy loam, loam, or gravelly loam.

Permeability is moderately slow to rapid in the soils of this unit. Roots can penetrate to a depth of 36 to more than 60 inches. Available water capacity is 3 to 12 inches. Runoff is slow to rapid, and the hazard of erosion is slight to high.

These soils are better suited to timber production than to cultivated crops. If these soils are cropped intensively, strong slopes and the hazard of erosion are major limitations. A lack of irrigation water and a low soil temperature also limit the use of these soils.

If water is available, the gently sloping soils are suitable for clearing and planting to irrigated orchards or pasture, and to a lesser extent, for dryland small grain and hay. Before these areas can be converted to cropland, methods must be used to control the growth of brush and tree sprouts if seed sources can not be eliminated.

A satisfactory production of forage is likely to require the use of nitrogen and phosphorus fertilizer and the control of deer on these soils. A permanent grass cover generally is needed to help to control erosion in orchards.

CAPABILITY UNIT IVe-3(17, 18, 22)

This unit consists of well-drained soils of the Kilarc, Millsap, Newtown, and Perkins series. These soils formed on terraces in alluvium from mixed rock sources. Slopes range from 3 to 30 percent. The surface layer is gravelly loam.

Permeability is slow in the subsoil. Roots can penetrate to a depth of 20 to 40 inches to weakly consolidated alluvium or sandstone, or to more than 60 inches. Available water capacity is 2 to 11 inches. Runoff is slow to rapid, and the hazard of erosion is slight to high.

These soils are better suited to an occasional small grain crop in a long rotation with pasture than to more intensive use. If water is available, these soils are well suited to irrigated pasture.

Sprinkling is an effective method of applying irrigation water because of the relief of these soils and the hazard of erosion. Tillage across the slope or on the contour helps to control erosion. A few areas need to be graded or smoothed before they can be farmed satisfactorily.

The production of small grain and forage can be improved by applying nitrogen and phosphorus fertilizer. If the soils are used for dryland pasture, the production of forage generally can be increased by removing shrubs and trees and planting and fertilizing adapted forage plants.

CAPABILITY UNIT IVe-5(15)

This unit consists of well-drained soils of the Sehorn series. These soils formed in material weathered from sedimentary rock. Slopes are 8 to 30 percent. The surface layer is silty clay.

Permeability is slow in the soils of this unit. Roots can penetrate to a depth of 16 to 40 inches. Available water capacity is 2.5 to 7 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

These soils are better suited to dryland small grain in a rotation with range or pasture than to other uses. A few areas need to be cleared of trees before they can be cultivated. If water is available, these soils are suitable for irrigated pasture.

Sprinkling is the best method of applying irrigation water because of the irregular slopes.

Using long-time rotation and cultivating across the slope help to control erosion and, along with applications of fertilizer, to maintain productivity of the soil. The control of gully erosion needs special measures in places. Small grain generally responds well to applications of nitrogen fertilizer, and irrigated pasture often benefits from applications of nitrogen and phosphorus fertilizer.

If these soils are used as range, the production and quality of forage can be improved by clearing trees and shrubs and fertilizing.

CAPABILITY UNIT IVe-7(22)

This unit consists of well-drained soils of the Aiken, Cohasset, Cone, Nanny, and Sites series. These soils formed in material weathered from volcanic rock. The surface layer is loam. Stones cover 0.1 to 3 percent of the surface. Stones or cobblestones make up 15 to 50 percent of the profile. Slopes are 0 to 30 percent.

Permeability is moderately slow to rapid in the soils of this unit. Roots can penetrate to a depth of 48 to more than 60 inches. Available water capacity is 4 to 9 inches. Runoff is slow to rapid, and the hazard of erosion is slight to high.

These soils are used mainly for timber production. If water is available, the soils at lower elevations are used for irrigated pasture or for orchards.

A few stones or cobblestones need to be removed from the surface in places if these soils are used for pasture. Cover crops should be grown in orchards to control erosion. Irrigation water is effectively applied by using sprinklers.

In wooded areas, thinning, pruning, the control of diseases and insects, and other management practices common to the area help increase the production and quality of timber. Tree planting is generally successful.

CAPABILITY UNIT IVe-8(17, 18)

This unit consists of well-drained soils of the Auburn, Clough, Kanaka, Parrish, Red Bluff, Redding, Supan, and Tuscan series. The very deep Red Bluff soils are in a complex with Redding soils. The soils in this unit formed in alluvium from mixed rock sources on old terraces or from a variety of rocks on uplands. The surface layer is sandy loam, loam, or gravelly loam for all these soils except Tuscan soils. Tuscan soils have a sur-

face layer of cobbly loam. Except for the Tuscan soil, these soils are underlain at a depth of 10 to 36 inches by a very slowly permeable hardpan or at a depth of 15 to 50 inches by hard bedrock. Tuscan soils have a hardpan at a depth of 8 to 20 inches. Available water capacity is mostly 2 to 7 inches in all these soils except Tuscan soils. Available water capacity is 1 to 3.5 inches in Tuscan soils. Runoff is slow to rapid, and the hazard of erosion is slight to high.

These soils are used mostly for dryland pasture and as range. If water is available, these soils are used for irrigated pasture. These soils are well suited to irrigated and dryland pasture. They are marginally suited to dryland hay and grain.

Cobblestones need to be removed from a few areas before they can be seeded. The fertility of these soils is so low that development of irrigation systems is seldom economically feasible. Sprinklers are the only practical method for irrigating most of these soils. Water ponds on these soils if they are over irrigated. Crops grown on these soils generally respond well to applications of nitrogen and phosphorus fertilizer. Areas that are hummocky generally need to be smoothed before they can be seeded, but cuts should not be so deep as to expose the hardpan.

CAPABILITY UNIT IVe-8(22)

Josephine gravelly loam, moderately deep, 10 to 30 percent slopes, is the only soil in this unit. It is a well-drained soil that formed in material weathered from sedimentary or metasedimentary rock.

Permeability is moderate in this soil. Roots can penetrate to a depth of 24 to 42 inches. Available water capacity is 3.5 to 7 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high.

This soil is better suited to growing timber than to other uses. If irrigation water is available, this soil is suited to orchard and pasture crops. At low elevations it is suited to field crops. At high elevations the temperature in fall, winter, and spring is low, and crops that can tolerate a cold climate must be selected.

Sprinklers are an effective means of applying irrigation water. This method helps to control erosion in orchards, especially if used along with a permanent grass cover. Crops grown on this soil generally respond well to applications of nitrogen and phosphorus fertilizer.

Under good management that includes such practices as thinning, pruning, controlling diseases and insects, and seeding or planting young trees, the production of timber in wooded areas can be improved.

CAPABILITY UNIT IVw-2(17)

This unit consists of well drained and moderately well drained soils of the Keefers, Moda, Molinos, and Reiff series. These soils formed in mixed alluvium. Slopes are 0 to 8 percent. The surface layer is mainly sandy loam or loam, but it is cobbly loam in a few places.

Permeability is very slow to rapid in the soils of this unit. Roots can penetrate to a depth of 10 to more than 60 inches. Available water capacity is 2 to 9 inches. These soils are either seeped and have a water table at a depth of 1 to 3 feet or they are channeled and are subject to overland flows of water. Most areas of these soils are traversed by a network of flood channels.

These soils are better suited to pasture and hay than to other uses. They are marginally suited to small grain and hay.

The production of forage is generally fair to good. On soils that are along the principal streams of the survey area, production is high. On soils that have a low water-supplying capacity, production generally is low.

Border and sprinkler irrigation are suitable for these soils, depending on the texture and permeability of the soil. Generally all these soils, except the Moda soils, can be leveled or smoothed with little risk of damage, but erosion is a very severe hazard if the soils are left bare in winter. A few soils benefit from applications of fertilizer, and other soils are suitable for clearing and seeding to hay and pasture plants. In a few areas crops can be grown more intensively if they are protected by levees.

CAPABILITY UNIT IVw-5(17)

Anita very cobbly clay, 0 to 8 percent slopes, is the only soil in this unit. It is a somewhat poorly drained soil that formed in materials weathered from tuff. Cobblestones cover 3 to 10 percent of the surface.

Permeability is slow on this soil. Roots can penetrate to a depth of 12 to 24 inches. Available water capacity is 2 to 4 inches. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil is very plastic and sticky when wet and extremely hard when dry. It shrinks as it dries, and wide cracks form. Because of this and the large number of cobblestones it is difficult to cultivate.

This soil is used for pasture. Proper surface drainage and the removal of cobblestones are needed for successful cultivation. If this soil is artificially drained, it is well suited to irrigated pasture.

Production can be improved if this soil is fertilized and seeded to adapted forage plants.

CAPABILITY UNIT IVs-0(17)

This unit consists of Cobbly alluvial land, an excessively drained land type that formed in sediment along the Sacramento River and its tributaries. The materials of this land type are stratified and porous, and the areas are flooded infrequently for short periods.

Permeability is very rapid. Runoff is very slow, and the hazard of erosion is none to slight. This land type is damaged mostly by bank erosion or by deposition. Roots can penetrate to a depth of 24 to 48 inches. Available water capacity is 2 to 4 inches.

This land type is better suited to irrigated or dryland pasture than to other uses.

A few irrigated areas need to be cleared of brush and trees. The production of forage on dryland pastures can be improved by similar clearing practices. The hazard of flood scour is severe in all areas that are left bare in winter. Flood scour can be controlled by seeding in spring. Pasture plants on this land type generally respond well to applications of nitrogen and phosphorus fertilizer.

CAPABILITY UNIT IVs-3(17)

This unit consists of well-drained or moderately well drained soils of the Hillgate and Moda series. These soils formed in alluvium from mixed sources. Slopes are 0 to 3 percent. The surface layer is loam or gravelly loam.

Permeability is slow or very slow in the soils of this unit. These soils are 8 to 24 inches deep over a very slowly permeable clay subsoil or hardpan or 24 to 36 inches deep

over a weakly consolidated substratum. Available water capacity is 2 to 6 inches. Runoff is very slow, and the hazard of erosion is none to slight.

These soils are used for dryland pasture and to a lesser extent for irrigated hay, pasture, and field or row crops. These soils are better suited to shallow-rooted crops than to other crops.

Leveling is needed in places to prepare these soils for more efficient cultivation. When leveling, however, deep cuts that would expose the subsoil should be avoided. Irrigation water must be applied very carefully as over-irrigation creates a perched water table above the subsoil. Irrigation water can be effectively controlled by use of sprinklers. Most crops respond well to applications of nitrogen and phosphorus fertilizer. Returning crop residue, green-manure crops, or other types of organic matter to the soil helps to maintain good structure and tilth and to increase the organic-matter content and soil fertility.

Grazing needs to be controlled to maintain an adequate cover of desirable forage plants and to reduce the hazard of erosion. These soils respond to such range or pasture improvement practices as fertilizing and seeding to adapted desirable forage plants.

CAPABILITY UNIT IVs-4(17)

This unit consists of somewhat excessively drained soils of the Tujunga series. These soils formed in alluvium from mixed parent materials. Slopes are 0 to 8 percent. The surface layer is loamy sand.

Permeability is rapid in the soils of this unit. Roots can penetrate to a depth of more than 60 inches. Available water capacity is 3 to 4 inches. Runoff is very slow to slow, and the hazard of erosion is none to slight.

These soils are used for irrigated pasture, prune trees, and row crops and other crops (fig. 9).

Irrigation water and fertilizer need to be applied in small amounts and at frequent intervals. Because permeability is rapid and available water capacity is low in this soil, overirrigation wastes water and leaches nutrients from the soil. Irrigation water should be applied with sprinklers. If furrow or border irrigation is used, runs should be short. Leveling or smoothing can be done without damaging the soils. Returning cover crops, green-manure crops, crop residue, or other forms of organic matter to the soil helps to improve the organic-matter content and fertility. Most soils respond well to applications of nitrogen and phosphorus fertilizer. A few crops respond favorably to applications of potassium or a few of the micronutrients.

Figure 9.—Young prune trees on Tujunga loamy sand, 0 to 3 percent slopes, of capability unit IVs-4(17). A sprinkler system is used for irrigation.

CAPABILITY UNIT IVs-8(17)

This unit consists of well-drained soils of the Redding, Red Bluff, and Tuscan series. These soils formed in alluvium from mixed rocks. Slopes are 0 to 3 percent. The surface layer is gravelly loam and cobbly loam.

Roots can penetrate to a depth of 8 to 30 inches to a very slowly permeable hardpan. Available water capacity is 1 to 5.5 inches. Runoff is very slow, and the hazard of erosion is none to slight.

These soils are better suited to irrigated pasture and dryland pasture than to other uses. They are marginally suited to dryland hay and small grain.

Cobblestones need to be removed from a few soils before they can be seeded to irrigated pasture. Smoothing of hummocks is needed in places because the intermound areas often are undrained, and water remains on the surface in winter. Border or sprinkler irrigation is suitable for use on these soils, depending on their smoothness. Because these soils are shallow, deep cuts should not be made during leveling, to avoid exposing the underlying clay or hardpan. These soils respond well to irrigation water that is applied in small amounts at frequent intervals. Installing irrigation systems, however, seldom is feasible unless inexpensive water is available. Applications of nitrogen and phosphorus fertilizer generally are needed to obtain satisfactory production of irrigated forage.

CAPABILITY UNIT VIe-1(15,17,18)

This unit consists of well-drained soils of the Auberry, Auburn, Gaviota, Inks, Kanaka, Millsap, Millsholm, Parrish, Newtown, Sehorn, Sierra, and Supan series. These soils formed in material weathered from a variety of rocks. Slopes are 3 to 50 percent. The surface layer ranges from sandy loam to silty clay loam. In a few areas stones

cover 1 to 3 percent of the surface or rock outcrops cover 2 to 10 percent of the surface.

Permeability is moderately rapid to slow in the subsoil. Roots can penetrate to a depth of mostly 16 to more than 60 inches. Available water capacity is mostly 2.5 to 12 inches. Runoff is slow to rapid, and the hazard of erosion is slight to high. One Sierra soil is severely eroded.

These soils are better suited to grazing than to other uses. They are not suited to cultivated crops. Where slopes are less steep, these soils are suited to pasture. Seedbeds are easier to prepare where the soils are free of rock outcrops.

Forage plants respond well to applications of nitrogen and phosphorus fertilizer, and applications of lime are helpful in places. On most soils used as range, the production and quality of forage can be improved by clearing trees and brush. If these soils are overgrazed or burned, brush tends to crowd out the grasses. After clearing brush a few soils need to be reseeded. All soils respond well to reseeding and fertilizing of adapted forage plants.

CAPABILITY UNIT VIe-1(22)

This unit consists of well-drained or somewhat excessively drained soils of the Boomer, Chaix, Cohasset, Corbett, Forward, Holland, Josephine, Kilarc, McCarthy, Marpa, Sites, and Windy series. These soils formed in material weathered from a variety of rocks. Slopes are 0 to 50 percent. The surface layer ranges from sandy loam to sandy clay loam.

Permeability is slow to rapid in the soils of this unit. Roots can penetrate to a depth of 20 to more than 60 inches. Available water capacity is 2 to 12 inches. Runoff is slow to rapid, and the hazard of erosion is slight to high.

All these soils except the Kilarc soils are better suited to growing timber than for other uses.

The rate of tree growth generally is high, but the quality of lumber can be improved by pruning and thinning trees and by controlling insects, diseases, and fires. Tree planting is desirable on a few soils. Careful logging practices are needed to control erosion, especially where slopes are steep. To help to control erosion, road gradients should be less than 12 percent. Ditches and culverts are needed on main roads to reduce runoff. Spreading slash on landings and skid trails after logging helps to prevent the forming of gullies.

On the Kilarc soils brush and tree removal increases the quantity of forage available to livestock or other animals. Seeding and fertilizing desirable plants helps to improve the range. Most plants grown on these soils respond well to applications of nitrogen and phosphorus fertilizer. Grazing needs to be controlled if these soils are used as range.

CAPABILITY UNIT VIs-1(15,18)

This unit consists of well-drained and somewhat excessively drained soils of the Auburn, Gaviota, Goulding, Guenoc, Inks, Millsap, Pentz, Sehorn, and Supan series. These soils formed in material weathered from a variety of rocks. Slopes are mostly 0 to 30 percent, but a few slopes are as much as 50 percent. The surface layer ranges from sandy loam to silty clay. About 3 to 15 percent of the surface is covered by stones, or 10 to 25 percent of the surface is exposed bedrock outcrops.

Permeability is moderately rapid to slow in the soils of this unit. Roots can penetrate to a depth of 6 to 40 inches. Available water capacity is 1 to 9 inches. Runoff is mdium to rapid, and the hazard of erosion is moderate to high.

These soils are better suited to range than to field crops or pasture. Vegetation is open to dense stands of brush and scattered oak trees and Digger pine.

Overgrazing causes brush to crowd out the grasses and increases the hazard of erosion. The production of forage can be improved by clearing brush and trees and by seeding and fertilizing. Stones and rocks on the surface, however, limit the use of equipment on these soils. Forage plants generally respond well to applications of nitrogen fertilizer.

CAPABILITY UNIT VIs-1(22)

This unit consists of moderately well drained to somewhat excessively drained soils of the Aiken, Behemotosh, Boomer, Cohasset, Cone, Diamond Springs, Jiggs, Kilarc, Lyonsville, McCarthy, Neuns, Sheetiron, Sites, and Windy series. These soils formed in material weathered from a variety of rock. Slopes are 8 to 50 percent. The surface layer ranges from sandy loam to clay loam. Stones cover 3 to 15 percent of the surface, or rock outcrops cover 10 to 25 percent of the surface.

Permeability is rapid to slow in the soils of this unit. Roots can penetrate to a depth of 18 to more than 60 inches. Available water capacity is 2 to 12 inches. Runoff is medium to rapid and the hazard of erosion is moderate to high.

All these soils except Kilarc soils are better suited to growing timber than to other uses. If these soils are used for irrigated pasture and hardy species of orchard trees, they need intensive management.

Timber trees grow at a rapid rate, and the quality of timber is good if the soils are well managed. The production of timber can be improved by pruning and thinning the trees and using measures to control fires, insects, and diseases. These soils are too stony for intensive cultivation.

Practices are needed to control regrowth of trees and brush unless seed sources are eliminated. Applying nitrogen and phosphorus fertilizer helps to increase the production and quality of forage.

Kilarc soils are used for grazing. They need good range management practices to control erosion and to maintain a cover of desirable forage plants. Kilarc soils respond well to seeding and fertilizing although stones greatly limit the use of mechanical ground equipment.

CAPABILITY UNIT VIIe-1(15, 18)

This unit consists of well-drained and somewhat excessively drained soils of the Auberry, Kanaka, Millsap, Millsholm, Parrish, and Sehorn series. These soils formed in material weathered from a variety of rocks. Slopes are 30 to 75 percent. The surface layer ranges from sandy loam to silty clay. Rock outcrops cover 2 to 10 percent of the surface in a few places. Depth to parent rock is 12 to 50 inches.

Permeability is moderately rapid to slow in the soils of this unit. Available water capacity is 1.5 to 9 inches. Surface runoff is rapid to very rapid, and the hazard of erosion is high to very high.

These soils are better suited to range and to watershed than to other uses. Steep to very steep slopes restrict the use of equipment on these soils for such operations as brush clearing and seeding and fertilizing forage plants.

These soils need to be protected from overgrazing and fires to help to control further erosion.

CAPABILITY UNIT VIIe-1(22)

This unit consists of well-drained to excessively drained soils of the Chaix, Corbett, Forward, Holland, Josephine, Marpa, and Sites series. These soils formed in material weathered from a variety of rocks. Slopes are 30 to 80 percent. The surface layer ranges from loamy coarse sand to loam or gravelly loam.

Permeability is rapid to moderately slow in the soils of this unit. Roots can penetrate to a depth of 18 to more than 60 inches. Available water capacity is 1.5 to 11 inches. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

These soils are better suited to timber production or to watershed than to other uses.

Because of the steep and very steep slopes, logging operations are difficult on these soils, and careful management is needed. Skyline, balloon, or helicopter logging is effective on these soils. Trees can be planted, but with great difficulty.

CAPABILITY UNIT VIIw-1(17, 18)

This unit consists of Cobbly alluvial land, frequently flooded, which is excessively drained. This land type consists of very gravelly or very cobbly sandy alluvium. It is in old channels of the larger streams throughout the central part of the area. It is subject to frequent flooding.

Permeability is rapid. Available water capacity is 1 to 3 inches.

This land type is used as range and as wildlife habitat. It is not practical to apply intensive range management practices.

CAPABILITY UNIT VIIs-1(15, 17, 18)

This unit consists of well-drained and somewhat excessively drained soils of the Auburn, Gaviota, Goulding, Guenoc, Henneke, Igo, Inks, Kidd, Lodo, Maymen, Millsholm, Pentz, Stonyford, Supan, and Toomes series. These soils formed in place or in alluvium from material of various rocks. Slopes are 0 to 75 percent. The surface layer ranges from sandy loam to clay loam and is gravelly or cobbly in places. Stones cover 3 to 20 percent of the surface, or rock outcrops cover 2 to 50 percent of the surface, or the soils are less than 12 inches deep.

Permeability is moderately rapid to moderately slow in all the soils of this unit except Igo soils. Permeability is very slow in the hardpan of Igo soils. Roots penetrate to a depth of 3 to 40 inches. Available water capacity is 0.3 to 7 inches. Runoff is slow to very rapid, and the hazard of erosion is slight to very high.

These soils are used as range or as watershed. These soils need to be protected from fires or overgrazing to control erosion. The grazing season is fairly short on these soils. These soils do not respond favorably to intensive management practices for improvement of range.

CAPABILITY UNIT VIIs-1(22)

This unit consists of well drained to excessively drained soils of the Behemotosh, Boomer, Cohasset, Cone, Corbett, Diamond Springs, Jiggs, Josephine, Lyonsville, McCarthy, Neuns, Sheetiron, and Windy series, and the land type Colluvial land. These soils formed in material weathered from a variety of rocks. Slopes are mostly 50 to 80 percent, but a few slopes are as gentle as 15 percent. The surface layer ranges from loamy coarse sand to clay loam. Stones cover 3 to 15 percent of the surface, or rock outcrops cover 5 to 25 percent of the surface. In one soil, stones make up 20 to 50 percent of the profile.

Permeability is rapid to moderately slow in the soils of this unit. Roots can penetrate to a depth of 18 or more than 60 inches. Available water capacity is 2 to 11 inches. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

Very steep slopes and stoniness or rockiness restrict the use of these soils to growing timber and light grazing by livestock. A few areas are inaccessible.

Where stands of trees are thin, logging generally is done by tractor. Where stands of trees are dense, cable logging is more practical, and there is less disturbance of the understory. Roads and landings need to be located on ridges to control erosion. Slash placed in skid trails helps to control erosion. Outsloping of temporary roads and culverts along main roads helps to remove runoff safely from roads. Management practices for the improvement of range are not practical.

CAPABILITY UNIT VIIIw-1(17)

This unit consists of the land types Gravel pits and Riverwash. Most of their features are variable.

These land types are suitable for wildlife habitat, recreation, and watershed. In places levees help to protect the adjacent soils that are used for farming from flood scour.

CAPABILITY UNIT VIIIs-1(15, 18, 22)

This unit consists of well-drained to excessively drained soils of the Lodo and Sheetiron series and of the land types Landslides, Rock land, Rubble land, and Tailings and Placer diggings. These soils formed in material weathered from a variety of rocks. Slopes are 30 to 90 percent. Stones cover 3 to more than 10 percent of the surface area of most of the soils, or rock outcrops cover 5 to 90 percent of the surface. The texture of the surface layer and most other soil features are variable, especially for the land types. Roots penetrate to a depth of 6 to 30 inches in the soils and to a depth of less than 10 to more than 60 inches in the land types.

Available water capacity is 0.3 to 4 inches in the soils, and it is variable in the land types. Permeability is rapid to moderately slow in the soils of this unit. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

These soils are better suited to wildlife habitat, recreation, and watershed than to field crops, pasture, range, or timber. The cover of plants needs to be protected from fire and overgrazing to help to control sedimentation.

Storie index rating [3]

The soils of the survey area are listed in the "Guide to Mapping Units" at the back of this soil survey and are rated according to the Storie index (*10*). This index expresses numerically the relative degree of suitability, or value, of a soil for general intensive farming. The rating is based on soil characteristics only and is obtained by evaluating depth, texture of the surface layer, density of the subsoil, drainage, content of salts and alkali, and relief.

[3] Ratings by EUGENE L. BEGG, University of California.

Availability of water for irrigation, climate, and distance from markets that determines the desirability of growing certain plants in a given locality are not considered. For this reason, the index cannot be considered an index of land value.

Four factors are considered in the index rating. These factors are: A—characteristics of the soil profile, including soil depth; B—texture of the surface layer; C—slope; and X—other factors, such as drainage, content of salts and alkali, and erosion. Each of these four factors is evaluated on the basis of 100 percent. A rating of 100 percent expresses the most favorable, or ideal, condition. Lower percentage ratings mean that conditions are less favorable for the production of crops.

Soils may be placed in grades according to their suitability for intensive use for farming, as shown by their Storie index ratings. The six grades and their range in index ratings are—

	Index rating
Grade 1	80 to 100
Grade 2	60 to 80
Grade 3	40 to 60
Grade 4	20 to 40
Grade 5	10 to 20
Grade 6	Less than 10

Soils of grade 1 are excellent, or well suited to intensive use for farming. Grade 2 soils are good and are also well suited to use for farming, although they are less desirable than soils of grade 1. Grade 3 soils are only fairly well suited, grade 4 soils are poorly suited, and grade 5 soils are very poorly suited to use for farming. Grade 6 consists of soils and land types that are not suited to farming.

Estimated yields [4]

The estimated yields listed in table 2 are based on observations made by soil scientists who surveyed this survey area, on information supplied by farmers, and on suggestions of the Agricultural Commissioner, Shasta County, and of crop specialists in the Agricultural Extension Service and the Soil Conservation Service. Federal and county census records and crop data were also reviewed and considered. More information was available for some soils than for others. If little or no information was available for a particular soil, or if the specified crop is not grown on the soil, yield estimates were made by comparison with similar soils.

Table 2 shows the yields of the principal crops grown under a high level of management on soils suited to the stated crops. A high level of management is that combination of practices that experience, field trials, and research indicate provides the highest returns at the present time.

Several important limitations should be kept in mind when using the yield estimates in table 2. First, the values are estimates, or predictions of yields that are expected over a period of years. Second, some soils have considerable variation in the effective depth to which roots can penetrate, in water-holding capacity, and in drainage. These variations were considered in making the estimates. Third, new crop varieties and improved management will increase the yields over those shown in the table. Yield varia-

[4] KENNETH C. CROENI, soil conservationist, Soil Conservation Service, assisted in preparing this section.

TABLE 2.—*Estimated yields per acre of the principal crops under a high level of management*

[Soils not suited to the stated crops are omitted from table. A dash in the column indicates that the soil is not used for the crop]

Soil name	Irrigated alfalfa hay	Irrigated pasture	Dryland pasture
	ton/acre	*AUM*[1]	*AUM*[1]
Anderson gravelly sandy loam	—	—	2.0
Anderson gravelly sandy loam, moderately deep	—	—	2.0
Anita clay, 0 to 8 percent slopes	—	—	3.5
Anita very cobbly clay, 0 to 8 percent slopes	—	—	3.0
Auberry fine sandy loam, 0 to 8 percent slopes	—	—	2.5
Auburn loam, 0 to 8 percent slopes	—	—	2.5
Auburn loam, 8 to 30 percent slopes	—	—	1.5
Auburn clay loam, 8 to 30 percent slopes, eroded	—	—	1.5
Churn loam, 0 to 3 percent slopes	7	18	3.0
Churn loam, 3 to 8 percent slopes	6	16	3.0
Churn loam, slightly wet, 0 to 3 percent slopes	6	16	—
Churn gravelly loam, 0 to 3 percent slopes	6	16	3.0
Churn gravelly loam, 3 to 8 percent slopes	—	16	3.0
Churn gravelly loam, deep, 0 to 3 percent slopes	—	16	3.0
Churn gravelly loam, deep, 3 to 8 percent slopes	—	16	3.0
Clough gravelly loam, 3 to 8 percent slopes	—	—	1.5
Cobbly alluvial land	—	—	1.0
Gaviota fine sandy loam, 3 to 15 percent slopes	—	—	1.0
Hillgate loam	5	14	2.5
Honcut loam	7	18	3.0
Honcut gravelly loam	6	16	3.0
Honcut gravelly loam, deep	6	16	3.0
Honn fine sandy loam, 0 to 3 percent slopes	6	16	3.0
Honn fine sandy loam, 3 to 8 percent slopes	6	16	3.0
Honn gravelly sandy loam, 0 to 3 percent slopes	6	14	2.5
Kanaka sandy loam, 3 to 15 percent slopes	—	—	1.5
Kanaka rocky sandy loam, 5 to 30 percent slopes	—	—	1.5
Keefers gravelly loam, 0 to 3 percent slopes	5	14	2.5
Keefers gravelly loam, 3 to 8 percent slopes	5	14	2.5
Keefers cobbly loam, channeled, 1 to 5 percent slopes	—	—	1.5
Kilare sandy clay loam, 2 to 15 percent slopes	—	—	2.5
Kilare sandy clay loam, 15 to 30 percent slopes	—	—	2.5
Los Robles loam, 0 to 3 percent slopes	6	18	3.5
Los Robles loam, 3 to 8 percent slopes	6	18	3.5
Los Robles loam, seeped, 0 to 3 percent slopes	6	18	3.5
Los Robles loam, moderately deep, 0 to 5 percent slopes	5	16	3.0

See footnote at end of table.

TABLE 2.—*Estimated yields per acre of the principal crops under a high level of management*—Continued

Soil name	Irrigated alfalfa hay	Irrigated pasture	Dryland pasture
	ton/acre	*AUM*[1]	*AUM*[1]
Los Robles gravelly loam, 0 to 3 percent slopes	5	16	3.0
Millsap loam, 5 to 30 percent slopes	----	----	3.0
Moda loam, 0 to 3 percent slopes	----	16	2.0
Moda loam, seeped, 0 to 3 percent slopes	----	16	2.0
Moda loam, shallow, 0 to 5 percent slopes	----	----	1.5
Molinos sandy loam, channeled	6	16	3.0
Molinos fine sandy loam	6	18	3.0
Molinos fine sandy loam, seeped	6	18	3.0
Myers silty clay, 0 to 3 percent slopes	8	18	3.5
Myers silty clay, 3 to 8 percent slopes	8	18	3.5
Newtown gravelly loam, 8 to 15 percent slopes	----	----	2.0
Newtown gravelly loam, 15 to 30 percent slopes	----	----	2.0
Parrish loam, 8 to 30 percent slopes	----	----	2.5
Perkins loam, 0 to 3 percent slopes	7	18	3.0
Perkins gravelly loam, 0 to 3 percent slopes	6	16	3.0
Perkins gravelly loam, 3 to 8 percent slopes	----	15	3.0
Perkins gravelly loam, 8 to 15 percent slopes	----	----	3.0
Perkins gravelly loam, 15 to 30 percent slopes	----	----	3.0
Perkins gravelly loam, seeped, 0 to 3 percent slopes	----	16	3.0
Perkins gravelly loam, moderately deep, 0 to 3 percent slopes	----	14	2.5
Perkins gravelly loam, moderately deep, 3 to 8 percent slopes	----	13	2.5
Red Bluff loam, 0 to 3 percent slopes	----	----	2.5
Red Bluff loam, 3 to 8 percent slopes	----	----	2.5
Red Bluff gravelly loam, moderately deep, 0 to 3 percent slopes	----	----	2.0
Red Bluff gravelly loam, moderately deep, 3 to 8 percent slopes	----	----	2.0
Redding gravelly loam, 0 to 3 percent slopes	----	----	1.5
Redding gravelly loam, 3 to 8 percent slopes	----	----	1.5
Redding-Red Bluff gravelly loams, 0 to 3 percent slopes	----	----	1.5
Redding-Red Bluff gravelly loams, 3 to 8 percent slopes	----	----	1.5
Reiff sandy loam, channeled, 0 to 8 percent slopes	----	----	2.5
Reiff fine sandy loam, 0 to 3 percent slopes	6	18	3.0
Reiff fine sandy loam, 3 to 8 percent slopes	6	18	3.0
Reiff fine sandy loam, deep, 0 to 3 percent slopes	5	16	----
Reiff gravelly fine sandy loam, deep, 0 to 3 percent slopes	5	16	2.5
Reiff loam, 0 to 3 percent slopes	7	18	----
Reiff loam, seeped, 0 to 3 percent slopes	6	18	----
Reiff gravelly loam, 0 to 3 percent slopes	6	16	----
Reiff gravelly loam, slightly wet, 0 to 3 percent slopes	6	16	3.5
Sehorn silty clay, 3 to 8 percent slopes	----	----	3.5
Sehorn silty clay, 8 to 30 percent slopes	----	----	3.5
Shingletown clay loam, 0 to 8 percent slopes	----	----	3.0
Shingletown loam, drained, 0 to 3 percent slopes	----	----	3.5
Sierra sandy loam, 3 to 8 percent slopes	----	14	3.0
Sierra sandy loam, 8 to 15 percent slopes	----	14	3.0
Sprekels sandy loam, 0 to 3 percent slopes	----	----	2.5
Sprekels sandy loam, 3 to 8 percent slopes	----	----	2.5
Supan gravelly loam, 5 to 15 percent slopes	----	----	2.5
Supan gravelly loam, 15 to 30 percent slopes	----	----	2.5
Tehama loam, 0 to 3 percent slopes	----	18	3.0
Tehama loam, 3 to 8 percent slopes	----	----	3.0
Tehama loam, 8 to 15 percent slopes	----	----	3.0
Tujunga loamy sand, 0 to 3 percent slopes	----	15	----
Tujunga loamy sand, 3 to 8 percent slopes	----	15	----
Tuscan cobbly loam, 0 to 3 percent slopes	----	----	2.5
Tuscan cobbly loam, 3 to 8 percent slopes	----	----	2.5
Vina loam, 0 to 3 percent slopes	7	18	----
Vina loam, seeped, 0 to 3 percent slopes	6	16	----
Vina gravelly loam, 3 to 8 percent slopes	6	16	3.5

See footnote at end of table.

[1] AUM means animal-unit-month and refers to the amount of forage or feed required to maintain one cow, horse, or mule or five sheep or goats, for 30 days without damage to the pasture.

tions between soils of different types, however, will probably still be valid.

Management by crop

Predictions or estimates of yields are useful if the management through which such yields were obtained is described. In the paragraphs that follow, management is described for each crop listed in table 2, where that crop is grown on soils of a specified capability unit. All the soils

in any one capability unit require about the same management for a specified crop. Because not all soils in a capability unit are used or are suited to the specific crop, it is necessary to check table 2 to determine the soils that are suited.

IRRIGATED ALFALFA

Typically, alfalfa is grown for 4 to 6 years and then sudangrass, silage corn, or milo is grown for 2 years. The soil is land planed to smooth the surface, then disked, springtooth harrowed, and spike harrowed. Seed is drilled into the soil at a rate of about 5 pounds per acre. Seeding is done between September 15 and October 15 or between March 1 and April 15. Phosphorus and sulfur are added in amounts determined by soil or plant tissue analysis. Irrigation is by flooding or by sprinkling. Alfalfa hay is cut at 0.1 percent bloom based on new growth. Insects, rodents, weeds, and diseases are controlled by locally adapted methods.

Group 1.—Soils of capability units I–1(17), IIe–1(17, 18) and IIIe–1(17, 18) are in this group. Irrigation on the level or nearly level soils is by flooding and on the sloping soils by sprinklers. About 7.5 to 9.5 inches of water is applied every 21 to 28 days throughout the growing season.

Group 2.—Soils of capability units IIs–3(17), IIIe–3(17, 22), IIIs–3(17), and IVs–3(17) are in this group. Irrigation on the level or nearly level soils is by flooding and on the sloping soils by sprinkler. Borders are longer than those in group 1. About 9.5 inches of water is applied every 29 days. Care must be used to avoid causing a perched water table to form above the slowly or very slowly permeable subsoil.

Group 3.—Soils of capability units IIs–0(17) and IIIs–0(17) are in this group. Irrigation on these soils is by flooding, and short runs are used. About 4.3 inches of water is applied every 10 days throughout the growing season.

Group 4.—Soils of capability unit IIs–4(17) are in this group. Irrigation is by flooding or by sprinklers. About 7.4 inches of water is applied every 19 days throughout the growing season.

Group 5.—Soils of capability units IIw–2(17, 22) and IVw–2(17) are in this group. Irrigation is by sprinklers or by flooding. About 9.5 inches of water is applied every 28 days. Care must be used to avoid raising the level of the water table. Protection is needed in areas that are subject to flooding.

Group 6.—Soils of capability units IIe–5(17) and IIs–5(17) are in this group. Irrigation is by sprinklers or by flooding. About 9.5 inches of water is applied every 28 days. Because these soils have a slow intake rate, water is applied under a low head.

IRRIGATED PASTURE

Under typical conditions soils are used for irrigated pasture for 6 to 8 years and are then used for annual crops for 2 years. If the soils are used for pasture, they are land planed or floated, disked, harrowed, ring rolled, and drilled. Nitrogen and phosphorus, and sometimes sulfur, are applied according to results of plant tissue or soil tests. Simple mixtures of one or two grasses and one legume are used. Seeding rates vary by plant species. Pastures generally are planted between October 15 and November 15. Livestock are excluded from the fields during irrigation and for 3 days after irrigation. Cross fencing is used to provide for rotation grazing. The pasture generally is clipped twice a year to aid in weed control and to increase utilization of grasses. Drainage ditches are installed if needed.

Group 1.—Soils of capability units I–1(17), IIs–0(17), and IIw–2(17,22) are in this group. Irrigation is by flooding on a grade of 0.3 percent. About 3.2 to 4.3 inches of water is applied every 8 to 10 days during the irrigation season.

Group 2—Soils of capability units IIe–1(17, 18), IIe–3(17), IIe–5(17), IIIe–1(17, 18), IIIe–3(17, 22), and IVe–1(18) are in this group. These are sloping soils, and irrigation is by sprinklers. The more gently sloping soils can be leveled and irrigated by flooding or by contour borders. About 3.5 inches of water is applied every 7 days throughout the irrigation season.

Group 3.—Soils of capability units IIs–3(17) and IIs–5(17) are in this group. Irrigation is by flooding on the level grade. About 4.3 inches of water is applied every 10 days. Because permeability and the intake of water is slow in these soils, water is applied under a low head.

Group 4.—Soils of capability units IIs–4(17), IIIs–3(17), IVs–3(17), and IVw–2(17) are in this group. Irrigation is by flooding on the level grade. About 3.5 inches of water is applied every 7 days.

Group 5.—Soils of capability units IIIs–0(17) and IVs–4(17) are in this group. Irrigation is by flooding or by sprinkling on the level grade. About 2 inches of water is needed every 10 days.

DRYLAND PASTURE

Typically, dryland pastures are disked, chiseled, springtooth harrowed, or plowed, or the seed is drilled directly into brush burns. Pastures are summer fallowed or sudangrass is grown in rotation. Grazing is withheld during the year of establishment of the pasture. Annuals are allowed to produce seedheads. In subsequent years livestock are allowed on the pasture when grasses are 4 to 6 inches high. At the end of the grazing season, the pasture has a uniformly patchy appearance. Stubble height should be 2 to 3 inches or more. Nitrogen, phosphorus, and sulfur are applied as indicated by plant tissue or soil tests.

Group 1.—The soils of capability units I–1(17), IIe–1(17, 18), IIe–3(17), IIe–5(17), IIs–3(17), IIs–5(17), IIIe–1(17, 18), IIIe–3(17, 22), IIIe–5(15), IIIe–8(18), IIIs–3(17), IIIw–5(17), IVe–1(18), IVe–3(17, 18, 22), IVe–5(15), IVe–8(17, 18), IVs–3(17), IVs–8(17), IV–5(17), and VIe–1(15), 17, 18) are in this group. Hardinggrass is used to provide earlier grazing or hardinggrass and legumes are used to extend the grazing season.

Group 2.—Soils of capability units IIs–0(17), IIs–4(17), IIw–2(17, 22), IIIs–0(17), IVs–0(17), IVs–4(17), IVw–2(17), and VIe–1(22) are in this group. These soils are planted to annual plants, such as rose clover or Lana vetch, alone or with Blando brome. Sufficient plants are allowed to mature to reseed areas on these soils.

Use of the Soils for Range

About 41 percent of the survey area is used for grazing. Soils of the Auburn, Goulding, Guenoc, Millsholm, Red Bluff, and Sehorn series are the most important producers of forage. Generally, the soils used for range are too steep, too shallow, or too stony or too rocky for cultivated crops.

Some soils formerly used for hay and small grain are now used for grazing.

Range sites

The basic unit on which management of range is determined is the range site. A range site is an area uniform enough in climate, soils, drainage, exposure, and topography that it produces a specific kind of and amount of vegetation. Most of the important forage plants in the survey area have been introduced. The original forage plants were a mixture of perennials and annuals, but the introduced plants are mostly cool-weather annuals. These annuals take full advantage of soil moisture while it is there, produce seed, and mature by the time the moisture is gone. They supply highly nutritious feed in spring when they are green and growing; but after they mature, their nutritional value is low.

The forage-producing plants of the survey area are grouped into three classes—desirable, less desirable, and undesirable. Livestock graze selectively. They seek the more palatable and nutritious plants. If grazing is not carefully regulated, the better, more desirable plants are weakened or eliminated because they are not allowed to produce seed. Less desirable plants then increase. If grazing pressure is continued, even the second choice plants are thinned out or eliminated, and undesirable, unpalatable plants take their place or the soil is left bare.

The range sites in the survey area are described in the following paragraphs. The soils that make up each range site are shown in the "Guide to Mapping Units" at the back of this survey.

SHALLOW LOAMY RANGE SITE

This is the most extensive range site in the survey area. It occupies approximately 153,000 acres. Elevation generally ranges from 500 to 1,800 feet, but one area is at an elevation of 3,000 feet. The annual precipitation ranges from 30 to 50 inches. In nearly 87,000 acres of this range site, the soils have slopes of less than 30 percent; in about 43,000 acres, they have slopes of 30 to 50 percent; and in 23,000 acres, they have slopes of more than 50 percent.

This range site is made up of clay loams, loams, gravelly loams, fine sandy loams, and sandy loams of the Auburn, Gaviota, Goulding, Guenoc, Inks, Millsholm, Pentz, Stonyford, and Supan series. These soils are 6 to 40 inches deep over bedrock (fig. 10).

The soils in this site have moderately rapid to moderately slow permeability and are well drained or somewhat excessively drained. Rock outcrops and stones are on the surface in some areas, but they do not appreciably affect the production of forage or the movement of livestock. Available water capacity is 1 to 6 inches. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. These soils are slightly acid to medium acid.

The herbaceous vegetation on this range site is dominantly annual grasses and forbs and some remnant perennial grasses. Where this site is producing at its potential, approximately 70 percent of the herbage is a mixture of such desirable plants as soft chess, needlegrass, pine bluegrass, wild oats, melicgrass, Spanish clover, bur clover, and filaree in the open or around and under scattered Digger pines and blue oak or interior live oaks. Approximately 20 percent of the vegetation consists of such less desirable plants as ripgut brome, annual fescue, wild barley, annual lupine, yarrow, and wild carrot. About 10 percent of the vegetation consists of such undesirable plants as fiddleneck, tarweed, turkey mullein, nitgrass, silver hairgrass, dogtail, and medusahead.

Figure 10.—Area of Guenoc very rocky loam, 0 to 30 percent slopes, in the Shallow Loamy range site.

Large acreages of this range site are in heavy to dense stands of brush or blue oak or both. Forage production can be greatly increased in these areas by clearing the brush or thinning the oaks that grow on the level to strongly sloping soils of the Auburn, Gaviota, Guenoc, Inks, and Millsholm series. These soils are also well suited to seeding to annual grasses and legumes. Forage plants grown on the soils of this unit respond well to the application of nitrogen, phosphorus, and sulfur fertilizer. Repeated applications of phosphorus fertilizer are needed to maintain a good stand of legumes.

This range site has an estimated total annual production of 2,000 pounds of air-dry forage per acre in favorable years and 800 pounds in unfavorable years. Approximately 80 percent of this production is from plants that provide forage for livestock and deer.

ACID TERRACE RANGE SITE

This range site occupies approximately 50,000 acres. Elevation ranges from 450 to 900 feet. The annual precipitation is 25 to 35 inches. Slopes are less than 8 percent.

This range site is made up of loams or gravelly loams of the Red Bluff and Redding series. These soils range from 10 to more than 60 inches deep over hardpan. The subsoil is clayey.

The soils in this site have moderately slow or very slow permeability in the subsoil, which restricts root and water penetration and provides only slowly available water to plants. These soils are well drained. Available water capacity is 2 to 10.5 inches. Runoff is very slow to medium, and the hazard of erosion is none to moderate. These soils are strongly acid to very strongly acid.

The herbaceous vegetation on this range site is a mixture of annual grasses and forbs and some palatable shrubs. Where this site is producing at its potential, approximately 70 percent of the herbage is a mixture of such desirable plants as soft chess, filaree, needlegrass, and Spanish clover. Approximately 20 percent of the vegetation consists of such less desirable plants as ripgut brome, annual fescue, wild barley, red brome, annual lupine, wild carrot, poison oak, and redbud. About 10 percent of the vegetation consists of such undesirable plants as nitgrass, silver hairgrass, wild buckwheat, wild onion, tarweed, and fiddleneck.

The soils in this range site can be seeded to adapted annual grasses and legumes. Fertilizer is needed to establish the seeded species. These soils have a serious phosphorus deficiency.

This range site has an estimated total annual production of 1,600 pounds of air-dry forage per acre in favorable years and 600 pounds in unfavorable years. About 85 percent of this production is from plants that produce forage for domestic livestock and native wildlife.

UPLAND TERRACE RANGE SITE

This is a grass-oak covered rangeland. It occupies approximately 62,000 acres. Elevation ranges from 500 to 1,000 feet. The annual precipitation ranges from 28 to 40 inches. In about 22,000 acres of this range site, the soils have slopes of less than 30 percent; in the remaining 40,000 acres, they have slopes of 30 to 50 percent.

This range site is made up of gravelly or stony loams of the Newtown series (fig. 11). The subsoil is light clay.

The soils in this range site have slow permeability in the subsoil, which restricts root and water penetration and provides only slowly available water to plants. Available water capacity is 9 to 11 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high. These soils are slightly acid to strongly acid.

The herbaceous vegetation on this range site is dominantly annual grasses and forbs. Where this site is producing at its potential, approximately 70 percent of the herbage is a mixture of such desirable plants as soft chess, wild oats, remnant perennial grasses, filaree, annual clover, Spanish clover, and a very small amount of bur clover.

Figure 11.—Area of Newtown gravelly loam, 30 to 50 percent slopes, eroded, in the Upland Terrace range site.

Approximately 20 percent of the vegetation consists of such less desirable plants as ripgut brome, annual fescue, wild barley, wild carrot, and annual lupine. About 10 percent of the vegetation consists of such undesirable plants as nitgrass, fiddleneck, tarweed, plantain, turkey mullein, California poppy, mustard, and medusahead.

Large acreages of this range site are in heavy stands of blue oak and brush. Forage production can be increased in these areas by clearing. The soils in this range site are suitable for seeding to adapted annual grasses and legumes. Forage plants grown on the soils of this site respond well to the application of nitrogen, phosphorus, and sulfur fertilizer. Repeated applications of phosphorus fertilizer are needed to maintain a good stand of legumes.

This range site has an estimated total annual production of 1,800 pounds of air-dry forage per acre in favorable years and about 800 pounds in unfavorable years. About 90 percent of this production is from plants that provide forage for livestock and wildlife.

LOAMY RANGE SITE

This is dominantly open grass-oak-covered rangeland that has some areas of dense oak or brush thickets. It occupies approximately 31,000 acres. Elevation ranges from 700 to 3,000 feet. The annual precipitation ranges from 30 to 60 inches. In about 16,000 acres of this range site, the soils have slopes of less than 30 percent; in 13,000 acres, they have slopes of 30 to 50 percent; and in only about 2,000 acres, they have slopes of more than 50 percent.

This range site is made up of loams or gravelly loams of the Millsap, Parrish, and Supan series. These soils are 20 to 40 inches deep over bedrock. The subsoil is somewhat finer textured than the surface layer.

The soils in this site have moderately slow to slow permeability and are well drained. Rock outcrops and stones are on the surface in some areas, but they do not appreciably affect the production of forage or the movement of livestock. Available water capacity is 3 to 9 inches. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high. These soils are medium acid to mildly alkaline.

The herbaceous vegetation on this range site is dominantly annual and remnant perennial grasses and annual forbs. Where this site is producing at its potential, approximately 70 percent of the herbage is a mixture of such desirable plants as soft chess, wild oats, needlegrass, California brome, blue wildrye, melicgrass, bur clover, filaree, annual clover, and Spanish clover, Approximately 20 percent of the vegetation consists of such less desirable plants as ripgut brome, annual fescue, wild barley, wild carrot, yarrow, and lupine. About 10 percent of the vegetation consists of such undesirable plants as nitgrass, silver hairgrass, dogtail, popcorn flower, fiddleneck, tarweed, turkey mullein, and thistles.

Large acreages of this range site are in heavy to dense stands of brush and oak. Forage production can be greatly increased in these areas by controlling brush and by seeding if equipment can be safely operated. All the soils in this range site, except the very steep soils of the Millsap and Parrish series, are well suited to Hardinggrass if an adequate seedbed can be prepared. All the soils except the very steep soils of the Millsap and Parrish series also well suited to seeding to adapted annual grasses and legumes, and forage plants grown on the soils of this site respond well to the application of nitrogen, phosphorus, and sulfur fertilizer. Repeated applications of phosphorus fertilizer are needed to maintain good stands of legumes.

This range site has an estimated total annual production of 2,600 pounds of air-dry forage per acre in favorable years and 1,400 pounds in unfavorable years. About 85 percent of this production is from plants that provide forage for cattle, sheep, and deer.

CLAYEY RANGE SITE

This is open grass-covered rangeland. It occupies approximately 25,000 arces. Elevation ranges from 800 to 1,600 feet. The annual precipitation ranges from 25 to 35 inches. In about 9,000 acres of this range site, the soils have slopes of less than 30 percent; in about 15,000 acres, they have slopes of 30 to 50 percent; and in about 1,000 acres, they have slopes of more than 50 percent.

This range site is made up of silty clays of the Sehorn series. These soils are 16 to 40 inches deep over shale, sandstone, or siltstone. The subsoil is clayey.

The soils in this site have slow permeability in the subsoil, which restricts root and water penetration. The soils are well drained. Available water capacity is 2.5 to 9 inches. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. These soils are neutral to medium acid. Some eroded and gullied areas are included in this range site. The areas are small and scattered throughout, generally on southern exposures.

The herbaceous vegetation on this site is mainly annual grasses and forbs. Where this site is producing at its potential, approximately 70 percent of the herbage is a mixture of such desirable plants as soft chess, remnant perennial grasses, filaree, annual clovers, and excellent stands of bur clover and wild oats. Approximately 20 percent of the vegetation consists of such less desirable plants as ripgut brome, wild barley, ryegrass, annual fescue, red brome, wild carrot, and annual lupine. About 10 percent of the vegetation consists of such undesirable plants as medusahead, nitgrass, dogtail, tarweed, fiddleneck, pipcorn flower, vinegar weed, turkey mullein, thistles, and mustard.

Brush generally is not heavy on this range site. All the soils in this range site, except for those in the Sehorn complex, 50 to 70 percent slopes, are well suited to seeding to hardinggrass. Adapted annual grasses and legumes are also well suited on the soils of this range site. Forage plants grown on the suitable soils of this site respond well to applications of nitrogen, phosphorus, or sulfur fertilizer. Repeated applications of phosphorus are needed to maintain good stands of legumes.

This range site has an estimated total annual production of 4,000 pounds of air-dry forage per acre in favorable years and 1,800 pounds in unfavorable years. About 90 percent of this production is from plants that provide forage for cattle and sheep.

FINE LOAMY RANGE SITE

This is an oak-Digger pine-grass-covered rangeland. It occupies approximately 20,000 acres. Elevation ranges from 600 to 3,000 feet. The annual precipitation ranges from 35 to 70 inches. In more than two thirds, or about 14,000 acres, of this range site, the soils have slopes of less than 30 percent; in the remaining 6,000 acres, they have slopes of 30 to 50 percent.

This range site is made up of sandy clay loams of the

Kilarc series. These soils are 25 to 45 inches deep over weakly weathered sandstone or shale. The subsoil is clay. Some areas are very stony.

The soils in this range site have slow permeability in the subsoil, which restricts root and water penetration, and the subsoil remains moist throughout the year. The soils are well drained. Available water capacity is 6 to 12 inches. These soils are slightly acid to extremely acid.

The herbaceous vegetation on this range site is a mixture of annual and perennial grasses and forbs. Where this site is producing at its potential, aproximately 70 percent of the herbage is a mixture of such desirable plants as blue wildrye, pine bluegrass, one-flowered oatgrass, needlegrass, California brome, melicgrass, soft chess, wild oats, and Spanish clover. Approximately 20 percent of the vegetation consists of such less desirable plants as annual fescue, squirreltail, ripgut brome, yarrow, wild carrot, blue blossom, and poison oak. About 10 percent of the vegetation consists of such undesirable plants as Medusahead, dogtail, nitgrass, tarweed, Jerusalem oak, buckhorn, white-leaf manzanita, and green-leaf manzanita.

Many areas of this range site are dense stands of oak and manzanita. Forage production can be greatly increased in these areas by clearing where equipment can be safely operated. The soils in this site are suitable for seeding to hardinggrass if an adequate seedbed can be prepared. They are also suitable for seeding to adapted annual grasses and legumes. Forage plants grown on the soils of this site respond well to the application of nitrogen, phosphorus, and sulfur fertilizer. Repeated applications of phosphorus are needed to maintain good stands of legumes.

This range site has an estimated total annual production of about 2,400 pounds of air-dry forage per acre in favorable years and 1,600 pounds in unfavorable years. About 85 percent of this production is from plants that provide forage for livestock and food and cover for wildlife.

GRANITIC RANGE SITE

This is a grass-oak-covered rangeland that has some areas of dense brush. It is the least extensive range site in the survey area, and it occupies approximately 14,000 acres. Elevation ranges from 700 to 1,500 feet. The annual precipitation ranges from 30 to 60 inches. In about 3,000 acres of this range site, the soils have slopes of 30 to 50 percent; in about 8,000 acres, they have slopes of less than 30 percent; and in about 3,000 acres, they have slopes of more than 50 percent.

This range site is made up of sandy loams or fine sandy loams of the Auberry, Kanaka, and Sierra series. These soils are 20 to 60 inches deep over granitic bedrock. The subsoil is loam to clay loam.

The soils in this site have moderately slow to moderately rapid permeability and are well drained or somewhat excessively drained. Rock outcrops are in some places. Available water capacity is 2 to 12 inches. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. These soils are neutral to very strongly acid.

The herbaceous vegetation on this range site is dominantly annual grasses and forbs. Where this site is producing at its potential, approximately 70 percent of the herbage is a mixture of such desirable plants as soft chess, wild oats, filaree, limited amounts of bur clover, and remnants of purple needlegrass. Approximately 20 percent of the vegetation consists of such less desirable plants as ripgut brome, red brome, annual fescue, wild barley, and annual lupine. About 10 percent of the vegetation consists of such undesirable plants as silver hairgrass, dogtail, nitgrass, popcorn flower, turkey mullein, vinegar weed, and California poppy.

Large areas of this range site are in heavy stands of brush along with Digger pine, knobcone pine, and oak. These areas are producing forage far below their potential. All the soils, except the strongly sloping to very steep soils of the Auberry and Kanaka series, can be cleared of brush and trees and seeded to adapted grasses and legumes. Forage plants grown on the soils of this site respond well to the application of nitrogen, phosphorus, and sulfur fertilizer.

This range site has an estimated total annual production of 1,800 pounds of air-dry forage per acre in favorable years and 1,100 pounds in unfavorable years. About 80 percent of this production is from plants that provide forage for cattle, sheep, and deer.

VERY SHALLOW VERY ROCKY RANGE SITE

This range site occupies nearly 55,000 acres. Elevation ranges from 800 to 2,000 feet. The annual precipitation ranges from 30 to 40 inches. In about 29,000 acres of this range site, the soils have slopes of less than 30 percent, much of which is less than 15 percent; and in the remaining 26,000 acres, they have slopes of 30 to 50 percent.

This range site is made up of loams of the Kidd and Toomes series. These soils are 4 to 20 inches deep over bedrock. The soils are very rocky or very stony (fig. 12).

The soils in this site are well drained or somewhat excessively drained. Available water capacity is 0.5 to 2.5 inches. Because of this low available water capacity, vegetation dries very early in spring. Runoff is medium to very rapid, and the hazard of erosion is moderate to very high. These soils are slightly acid to strongly acid.

The herbaceous vegetation on the accessible areas of this range site is a mixture of annual grasses and forbs. Where this site is producing at its potential, approximately 70

Figure 12.—**Area of Toomes very rocky loam, 0 to 50 percent slopes, in the Very Shallow Very Rocky range site.**

percent of the herbage is a mixture of such desirable plants as soft chess and filaree and, in favorable years, fair stands of annual clovers and some bur clover. Approximately 20 percent of the vegetation consists of such less desirable plants as red brome, annual fescue, mouse barley, and annual lupine. About 10 percent of the vegetation consists of such undesirable plants as owl clover, brodiaea, popcorn flower, and vinegar weed.

The vegetative covers on this site generally is sparse. The productivity of the soils in this range site does not justify expenditures needed for a program of controlling brush, seeding, or fertilizing.

This range site has an estimated total annual production of 1,200 pounds of air-dry forage per acre in favorable years and about 500 pounds in unfavorable years. About 75 percent of this production is from plants that provide forage for domestic livestock.

VERY SHALLOW LOAMY RANGE SITE

This is a brush-grass-oak-Digger pine-covered rangeland. It occupies approixmately 9,000 acres. Elevation ranges from 600 to 2,500 feet. The annual precipitation ranges from 30 to 45 inches. In about 17,000 acres, of this range site the soils have slopes ranging to 60 percent; in about 20,000 acres they have slopes ranging to more than 50 percent.

This range site is made up of gravelly loams or shaly loams of the Henneke, Igo, Lodo, and Maymen series. These soils generally are 3 to 24 inches deep over bedrock or hardpan. Some areas are very rocky or very stony.

The soils in this site have moderate to very slow permeability and are well drained to somewhat excessively drained. Available water capacity is 0.3 to 3 inches. Runoff is slow to very rapid, and the hazard of erosion is slight to very high. The soils are strongly acid to slightly acid.

The herbaceous vegetation on the accessible areas of this range site is a mixture of annual and perennial grasses and annual forbs. Where this soil is producing at its potential, approximately 55 percent of the herbage is a mixture of such desirable plants as soft chess, remnant perennial grasses, filaree, annual clovers, and Spanish clover around and under scattered brush plants. Approximately 35 percent of the vegetation consists of such less desirable plants as red brome, annual lupine, poison oak, wild carrot, and large amounts of annual fescue. About 10 percent of the vegetation consists of such undesirable plants as owls clover, goldfields, brodiaea, popcorn flower, vinegar weed, nitgrass, and silver hairgrass.

This range site is dominantly brush and trees if it is in poor condition. The productivity of the soils in this range site does not justify the expenditure needed for a program of controlling brush, seeding, or fertilizing.

This range site has an estimated total annual production of about 1,000 pounds of air-dry forage per acre in favorable years and about 400 pounds in unfavorable years. About 70 percent of this production is from plants that provide forage for domestic livestock and wildlife.

Woodland Uses of the Soils

About 42 percent, or 433,000 acres, of the survey area is capable of supporting commercially valuable forests. Of this area approximately 70,000 acres is owned by the Federal government, 9,000 acres by the State of California, and 354,000 acres by private individuals or corporations.

Douglas-fir is the most important kind of tree grown commercially. Other conifers are ponderosa pine, Jeffrey pine, sugar pine, white fir, red fir, and incense cedar. Lodgepole pine is only at high elevations. Digger pine, knobcone pine, and several other noncommercial conifers are in the survey area. Black oak and canyon live oak are throughout the survey area on soils suited to the commercially valuable conifers and in areas in association with them. Several other species of oak—interior live oak, blue oak, Oregon white oak, and valley oak—are in the survey area. Trees along stream bottoms are cottonwood, willow, alder, Oregon ash, and sycamore.

Woodland suitability groups

To assist woodland owners in planning use of their soils, the soils of the survey area have been placed in seven woodland suitability groups. Each group is made up of soils that have similar characteristics, respond to similar management, and have similar hazards and limitations for the production of wood crops.

Each woodland suitability group is described, and factors that affect management are discussed. Soils that have not been placed in a woodland suitability group are not suited to trees, or they are better suited to other uses. The soils in each woodland suitability group are shown in the "Guide to Mapping Units".

Much of the information on woodland suitability groups was supplied by the Pacific Southwest Forest and Range Experiment Station, Berkeley, California (*5*, *7*). The rest was collected by the Soil Conservation Service.

In the soils of each woodland suitability group, the best indicator of soil productivity is the height of the tallest trees at a specified age. This height, in feet, is called site index. For convenience, a series of site indexes can be grouped and called site quality. In the survey area, woodland soils are grouped in three site qualities, *high*, *medium*, and *low*, as follows: site quality is *high* where the site index is more than 115; site quality is *medium* where the site index ranges from 75 to 115; and site quality is *low* where the site index is less than 75.

In Shasta County Area, effective depth of soil is the most important soil feature that affects site quality. Effective depth is the thickness of soil over the bedrock or over a layer that prevents or restricts the penetration or growth of tree roots. Texture influences effective depth where there is a dense layer that restricts drainage or the growth of roots. Moderate amounts of loose stones, cobblestones, or gravel in the profile have little effect on the growth of trees, especially if the soil is deep. Soils that are extremely stony or cobbly diminish the rate of tree growth in proportion to the amount of coarse fragments in the profile.

Site quality refers to that for ponderosa pine, which is the only species in the survey area for which adequate site and yield tables have been published. Studies show that other coniferous trees growing in association with ponderosa pine have about the same height-age relationship as ponderosa pine. The site index for ponderosa pine at the age of 100 years, based on measurements of dominant and codominant trees, ranges from 60 to 150. Table 3 shows the yields that can be expected from well-stocked, unmanaged, even aged stands of ponderosa pine.

TABLE 3. *Yields per acre from well-stocked, unmanaged, even-aged stands of ponderosa pine*

[Adapted from USDA Tech. Bul. 630 (7). Tree sizes refer to diameter breast high (DBH). Volume according to International rule assumes a kerf of ⅛ inch; that for Scribner rule, a kerf of ¼ inch. Site index of more than 115 is *high* site quality; 75 to 115, *medium* site quality; and less than 75, *low* site quality. Dashes indicate that item does not apply]

Site index	Age (years)	Total merchantable volume		
		Cubic feet in trees 6.6 inches and larger	Board feet—In trees 6.6 inches and larger (International rule)	Board feet—In trees 11.6 inches and larger (Scribner rule)
60	30	50	—	—
	40	310	500	—
	50	820	1,800	100
	60	1,450	3,700	600
	70	2,080	6,100	1,800
	80	2,650	8,800	3,500
	90	3,150	11,700	5,500
	100	3,570	14,600	7,800
	110	3,930	17,400	10,200
	120	4,240	20,000	12,500
	130	4,500	22,300	14,700
	140	4,710	24,400	16,700
70	30	210	400	—
	40	720	1,900	100
	50	1,480	4,500	700
	60	2,220	7,600	2,200
	70	2,920	11,200	4,300
	80	3,530	15,000	7,000
	90	4,050	18,600	10,000
	100	4,480	22,000	13,100
	110	4,850	25,000	16,200
	120	5,170	27,700	19,000
	130	5,440	30,200	21,500
	140	5,670	32,500	23,700
80	20	20	—	—
	30	420	1,100	—
	40	1,290	3,700	600
	50	2,240	7,700	2,300
	60	3,100	12,600	5,100
	70	3,820	17,900	8,500
	80	4,440	23,100	12,200
	90	4,970	27,500	16,000
	100	5,410	31,200	19,700
	110	5,790	34,400	23,100
	120	6,120	37,300	26,200
	130	6,400	40,000	29,000
	140	6,640	42,500	31,500
90	20	140	200	—
	30	1,060	2,800	200
	40	2,880	7,100	1,900
	50	3,390	12,700	5,000
	60	4,340	19,000	9,100
	70	5,090	25,400	13,800
	80	5,720	31,100	18,500
	90	6,250	36,100	23,000
	100	6,700	40,300	27,200
	110	7,080	43,900	31,100
	120	7,410	47,200	34,700
	130	7,690	50,200	38,000
	140	7,950	53,000	40,900
100	20	350	600	—
	30	1,770	5,400	1,000
	40	3,260	11,900	4,300
	50	4,540	19,300	9,200
	60	5,660	27,000	14,800
	70	6,350	34,000	20,500
	80	7,020	40,200	26,000
	90	7,600	45,600	31,200
	100	8,090	50,300	36,100
	110	8,500	54,500	40,600
	120	8,850	58,200	44,600
	130	9,150	61,600	49,300
	140	9,450	64,800	51,700
110	20	830	1,400	100
	30	2,630	8,200	2,500
	40	4,290	17,000	7,500
	50	5,710	26,400	14,000
	60	6,820	35,300	21,000
	70	7,710	43,200	27,800
	80	8,460	50,100	34,200
	90	9,090	56,300	40,200
	100	9,620	61,800	45,800
	110	10,100	66,600	50,800
	120	10,500	71,000	55,400
	130	10,850	75,000	59,600
	140	11,200	78,000	63,400
120	20	1,300	2,800	400
	30	3,420	12,500	5,100
	40	5,260	23,900	12,100
	50	6,790	35,200	20,300
	60	8,000	45,400	28,400
	70	9,040	54,300	36,400
	80	9,940	62,200	43,900
	90	10,700	69,300	50,800
	100	11,350	75,600	57,100
	110	11,900	81,300	62,900
	120	12,400	86,400	68,200
	130	12,850	91,000	73,000
	140	13,250	95,200	77,400
130	20	1,840	4,500	900
	30	4,320	17,400	8,400
	40	6,380	31,400	17,600
	50	8,050	44,400	27,400
	60	9,420	56,000	37,000
	70	10,600	66,300	46,200
	80	11,640	75,400	54,800
	90	12,550	83,500	62,700
	100	13,350	90,800	70,000
	110	14,050	97,500	76,700
	120	14,650	103,600	82,800
	130	15,150	108,900	88,300
	140	15,550	113,800	93,200

TABLE 3.—*Yields per acre from well-stocked, unmanaged, even-aged stands of ponderosa pine*—Continued

Site index	Age (years)	Total merchantable volume: Cubic feet in trees 6.6 inches and larger	Board feet—In trees 6.6 inches and larger (International rule)	Board feet—In trees 11.6 inches and larger (Scribner rule)	Site index	Age (years)	Total merchantable volume: Cubic feet in trees 6.6 inches and larger	Board feet—In trees 6.6 inches and larger (International rule)	Board feet—In trees 11.6 inches and larger (Scribner rule)
140	20	2, 520	7, 300	1, 900	150	20	3, 150	10, 800	3, 800
	30	5, 150	23, 200	11, 800		30	5, 950	28, 800	16, 000
	40	7, 379	39, 000	23, 100		40	8, 320	46, 400	29, 200
	50	9, 240	53, 400	34, 600		50	10, 420	62, 500	42, 500
	60	10, 860	66, 400	45, 800		60	12, 260	77, 000	55, 300
	70	12, 260	78, 100	56, 500		70	13, 850	90, 200	67, 300
	80	13, 460	88, 700	66, 500		80	15, 150	102, 300	78, 600
	90	14, 550	98, 300	75, 800		90	16, 250	113, 300	89, 200
	100	15, 450	107, 000	84, 400		100	17, 200	123, 300	99, 100

Average yields of wood per acre per year from trees growing on soils of high site quality should be 700 board feet or more. Those from trees growing on soils of medium site quality should be 300 to 700 board feet, and those from trees growing on low site quality soils, less than 300 board feet. The average annual growth should increase if good management is applied.

Hazards and limitations of the soils that affect woodland management and that are rated in the discussions of the woodland suitability groups are described in the paragraphs that follow.

The hazard of erosion refers to the potential soil erosion that is likely to occur following cutting operations or where soil is exposed along roads, trails, fire lanes, and log decking areas. Length and steepness of slope, texture, and stability of the soil aggregates are considered in rating the erosion hazard. If soils are kept under a protective cover of forest litter and duff, they generally do not erode. Consequently, the soils are rated according to their susceptibility to erosion if the cover is removed through fire, logging, trampling by animals, or other disturbances. The susceptibility of forest soils to erosion if they are cultivated is not considered in rating the erosion hazard. The rating criteria for erosion hazard are *none*, *slight*, *moderate*, *high*, and *very high*. A rating of *slight* indicates that few or no problems of erosion control exist. A *very high* rating means that very intensive management or soil treatments are needed to minimize erosion, or that the soil should be left in native cover. A *moderate* or a *high* rating indicates that the problems of erosion control are intermediate to those for the rating criteria of slight and very high.

Equipment limitations refer to the characteristics of the soils that restrict or prevent the use of equipment for tending and harvesting trees. For example, equipment limitations are slight on Aiken loam, 8 to 15 percent slopes, except when it is wet. When this soil is wet, which is 6 months out of a year in some years, heavy equipment mires down. Tree-planting machines can be used on this soil, however, at carefully selected times. Steep soils and large boulders on the surface increase the limitation to use of equipment; sand or gravel decreases the limitation. The rating criteria for equipment limitations are *slight*, *moderate*, and *severe*. A rating of *slight* means that equipment use is not restricted in kind or time. *Moderate* means that equipment use is somewhat restricted by such soil properties as slope and stones or rock outcrops. A *severe* rating means that special equipment is needed, and its use is severely restricted by such soil properties as slope and stones or rock outcrops.

Pest and disease hazards depend on many properties and qualities of the soil. Depth, texture, and inherent fertility of the soil are three important factors. The rating criteria for the hazard of pests and disease are *slight*, *moderate*, and *severe*. A rating of *slight* indicates that no damage or only slight damage to timber can be expected. A rating of *moderate* means that some losses of timber can be expected. A rating of *severe* indicates that considerable loss of timber can be expected.

Windthrow hazard is the danger of trees being blown down by wind. It generally is not serious except on shallow soils derived from slate, shale, schist, or granitic material. The ratings are *slight*, *moderate*, and *severe*. A rating of *slight* means that very few or no trees can be expected to be blown down by commonly occurring winds. *Moderate* means that some trees can be expected to be blown down during periods of high winds. A rating of *severe* indicates that many trees can be expected to be blown down during high winds.

The level of management required is based on all the qualities of a soil for growing trees and the management practices needed to promote good growth of the trees. The

levels of management are *high*, *medium*, and *low*. A rating of *high* means that the soil is suited to a high level or intensive management. A rating of *medium* indicates a moderate level of management. A *low* rating means that the soil is suited to only limited management.

The woodland suitability groups recognized in the survey area are described in the paragraphs that follow.

WOODLAND SUITABILITY GROUP 1

The soils in this group are well-drained loams and sandy loams of the Aiken, Nanny, and Windy series (fig. 13). Depth to bedrock is more than 60 inches. In some places these soils are stony or gravelly. Slopes are as steep as 15 percent.

The soils in this group are among the most productive in the survey area for wood crops, and they are suited to intensive management. They have high site quality and slight hazards of erosion, windthrow, and pests and disease. Equipment limitations are slight.

The growth rate of trees on these soils is rapid. Economic returns from trees grown on soils of this group are realized early. Seedlings become established easily after logging and grow rapidly to maturity. Trees on the soils in this group can be thinned and pruned until the trees are moderately large. Logging generally is easy, but during periods of wetness equipment bogs down in some low or level areas. Snow interferes with the use of heavy equipment in areas that are at high elevations.

Roads generally are easy to locate and to build. In some places roads may need to be gravelled for year-round use. Roads and skid trails need to be protected from damage caused by runoff. Heavy duty roads need bridges, ditches, and culverts. The surfaces of temporary and minor roads need to be outsloped. Grades for such roads should slope downward toward the watercourse for a short distance on both sides of draws or creeks.

Fire is relatively easy to control, chiefly because of easy access, but also because slopes are gentle to moderate.

Areas from which trees have been removed by fire or logging are easy to prepare for planting seedlings by use of machines.

WOODLAND SUITABILITY GROUP 2

The soils in this group are well-drained loams of the Aiken, Cohasset, Josephine, and McCarthy series (fig. 14). Depth to bedrock is 40 to more than 60 inches. In most places these soils are stony or gravelly. Slopes are generally 15 to 30 percent, but in places they are less than 15 percent.

The soils in this group are suited to intensive management and are easy to manage. They have high site quality, moderate hazard of erosion in most places, and slight hazards of windthrow and pests and disease. Equipment limitations are generally moderate.

The growth rate of trees on these soils is rapid. Economic returns from trees grown on soils of this group are realized early. Seedlings become established easily after logging and grow rapidly to maturity. Trees on the soils in this group can be thinned and pruned, even after the trees have grown to a moderately large size. Logging is more difficult than on soils in group 1 because these soils are steeper in most places. During periods of wetness logging is impractical, except on the gently sloping soils.

Roads are fairly difficult to locate and to build. In places

Figure 13.—**Ponderosa pine growing on an area of Nanny stony sandy loam, 0 to 8 percent slopes, which is in woodland suitability group 1.**

roads may need to be gravelled for year-round use. Roads and skid trails need to be protected from damage caused by runoff. Larger roads need bridges, ditches, and culverts. The surfaces of temporary or minor roads need to be outsloped. Grades for such roads should slope downward to-

Figure 14.—Area of Cohasset stony loam, 0 to 30 percent slopes, in woodland suitability group 2. The trees are ponderosa pines.

ward the watercourse for a short distance on both sides of creeks and draws.

Fire is difficult to control because of the steep slopes in most places.

Areas from which trees have been removed by fire or other means are difficult to prepare for planting. If planting is done by machine, the steeper soils need terraces. Such terraces should be outsloped.

WOODLAND SUITABILITY GROUP 3

The soils in this group are well-drained to somewhat excessively drained sandy loams and loams of the Cohasset, Jiggs, and Lyonsville series. Depth to bedrock is 40 to more than 60 inches. These soils generally are stony or very stony. Slopes are generally 30 to 70 percent, but in places they are 10 percent.

The soils in this group are suited to intensive management, except the very steep soils, and they are easy to manage. They have high site quality, high to very high hazard of erosion, and slight hazards of windthrow and pests and disease. Equipment limitations are severe.

The growth rate of trees on these soils is rapid. Economic returns from trees grown on the soils of this group are realized early. Seedlings become established easily after logging and grow rapidly to maturity. Trees on the soils of this group can be thinned and pruned even after the trees have grown to a moderately large size. Logging is very difficult on these soils. Logging is impractical during periods of wetness, and at high altitudes deep snows make logging impossible in winter.

Roads generally are difficult to locate and to build. In some places they may need to be gravelled for year-round use. Roads and skid trails need to be protected from damage caused by runoff. Larger roads need bridges, ditches, and culverts. The surfaces of temporary or minor roads need to be outsloped. Grades for such roads should slope downward toward the water course for a short distance on both sides of creeks or draws.

Fire is very difficult to control because of the steep to very steep slopes in many places.

Areas from which trees have been removed by fire or other means are very difficult to prepare for planting. If planting is done by machine, terracing is needed. Such terraces should be outsloped. In many places planting by machine is impractical.

WOODLAND SUITABILITY GROUP 4

The soils in this group are well-drained loams of the Aiken, Boomer, Cone, and Sites series. Depth to bedrock is 40 to more than 60 inches. In most places these soils are stony or gravelly. Slopes are 0 to 15 percent.

The soils in this group are suited to medium intensity management, and they are moderately easy to manage. They have medium site quality and slight to moderate hazard of erosion. The windthrow hazard is dominantly slight, but it is moderate in places. The hazard of pests and disease is slight. Equipment limitations are mostly slight.

The growth rate of trees on these soils is moderate. Economic returns from trees grown on soils in this group are not realized as early as those in groups 1, 2, and 3. Trees on the soils in this group can be thinned at an early

490-726—74——7

age, and they can be pruned before they reach a diameter of 15 inches at breast height. Damage from pests can be expected, but it is excessive only in extremely dry years. Logging generally is easy on these soils, but heavy equipment bogs down in level or nearly level areas. At high altitudes deep snows make logging impossible in winter in most years.

Roads are fairly easy to locate and to build. In places they need to be gravelled for year-round use. Roads and skid trails need to be protected from damage caused by runoff. Large roads need bridges, ditches, and culverts. The surfaces of temporary or minor roads should be outsloped. Grades for such roads should slope downward toward the watercourse for a short distance on both sides of draws or creeks.

Fire is relatively easy to control because of easy access, and most of these soils are gently sloping to moderately sloping.

Areas from which trees have been removed by fire or other means are fairly easy to prepare for planting. Planting generally can be done by machine, but stoniness makes the use of machines difficult in places.

WOODLAND SUITABILITY GROUP 5

The soils in this group are well-drained to somewhat excessively drained loamy coarse sands to loams. These soils are in the Aiken, Boomer, Chaix, Cohassett, Cone, Corbett, Forward, Holland, Jiggs, Josephine, Lyonsville, Marpa, McCarthy, Neuns, Sheetiron, Sites, and Windy series. Depth to bedrock is 20 to more than 60 inches. In most places these soils are gravelly, stony, very stony, or very rocky. Slopes typically are 15 to 50 percent, but some areas are less sloping.

The soils in this group are suited to medium intensity management, but they are difficult to manage. They have medium site quality, moderate to high hazard of erosion, slight or moderate hazard of windthrow, and slight hazard of pests and disease. Equipment limitations are moderate to severe.

The growth rate of trees on these soils is moderate. Economic returns from trees grown on soils in groups 1, 2, and 3 are realized earlier and are greater than those from trees in this group. Trees on the soils in group 5 can be thinned at an early age, and they can be pruned before they reach a diameter of 15 inches at breast height. Damage from pests can be expected, but it is excessive only in extremely dry years. Logging generally is difficult on these soils because of steepness of slopes. During periods of wetness, logging operations are impractical on all the soils in this group except on the gently sloping soils.

Roads are fairly difficult to locate and to build. In most places they need to be gravelled for year-round use. Roads and skid trails need to be protected from damage caused by runoff. Heavy-duty roads need bridges, ditches, and culverts. The surfaces of temporary or minor roads should be outsloped. Grades for such roads should slope downward toward the watercourse for a short distance on both sides of creeks or draws.

Fire is difficult to control because of the dominantly steep slopes.

Areas from which trees have been removed by fire or logging are difficult to prepare for planting seedlings. If planting is done by machine, terraces are needed where slopes are steep. Such terraces should be outsloped.

WOODLAND SUITABILITY GROUP 6

The soils in this group are well-drained to excessively drained loamy coarse sands, sandy loams, and loams. These soils are in the Boomer, Chaix, Cohasset, Corbett, Holland, Jiggs, Josephine, Lyonsville, Marpa, McCarthy, Neuns, Sheetiron, Sites, and Windy series. Colluvial land is also in this group. Depth to bedrock is 18 to more than 60 inches. In places these soils are gravelly, stony, very stony, or very rocky. Slopes are dominantly 50 to 80 percent, but in a few places slopes are as gentle as 30 percent.

The soils in this group are suited to medium intensity management, but management is difficult. They have medium site quality. The hazard of erosion is very high, and the hazard of windthrow is slight to moderate. The hazard of pests and disease is slight, and equipment limitations are severe.

The growth rate of trees on these soils is moderate. Economic returns from trees grown on soils in groups 1, 2, and 3 are realized earlier and are greater than those from trees in this group. Trees on the soils in group 6 can be thinned at an early age, and they can be pruned before they reach a diameter of 15 inches at breast height. Damage from pests and disease can be expected, but it is excessive only in extremely dry years. Logging is very difficult on all these soils.

Roads are difficult to locate and to build. In places they need to be gravelled for year-round use. Roads and skid trails need to be protected from damage caused by runoff. Large roads need bridges, ditches, and culverts. The surfaces of temporary or minor roads should be outsloped. Grades for such roads should slope downward toward the watercourse for a short distance on both sides of creeks or draws.

Fire is difficult to control because of the dominantly steep and very steep slopes.

Areas from which trees have been removed by fire or other means are difficult to prepare for planting. Planting by machine is not practical on the soils in this group.

WOODLAND SUITABILITY GROUP 7

The soils in this group are well-drained to excessively drained clay loams, loams, sandy loams, or loamy coarse sands of the Behemotosh, Boomer, Chaix, Cohasset, Corbett, Diamond Springs, McCarthy, and Windy series. Depth to bedrock is 18 to 60 inches. In most places these soils are very stony or very rocky. Slopes are dominantly 30 to 80 percent, but in a few places the range is as low as 8 percent.

The soils in this group are the least productive of all the soils in this survey area for wood crops. Only such extensive management practices as protection from fire, pests and disease, overgrazing, and erosion are practical. More intensive measures are practical in places that can be improved for recreation or wildlife habitat. The soils in this group have low site quality. The hazard of erosion is moderate, high, or very high. The hazards of windthrow and pests and disease are moderate and severe. Equipment limitations are severe.

Use of the Soils for Wildlife [5]

Hunting and fishing are important factors in the economy of the Shasta County Area. They furnish not only recreational opportunities for the local residents, but they also produce direct and indirect income. As the pressure of human population increases in California and wildlife habitat decreases, the value of hunting and fishing will continue to increase and fish and wildlife will assume even more importance in the economy.

The survey area hosts a wide variety of wildlife. Shasta County ranks high in California in the numbers of black-tailed deer, black bear, mountain lion, and band-tailed pigeon; and it is noted for its salmon, steelhead, and trout fishing. Other kinds of wildlife in the survey area are mourning doves, California quail, mountain quail, gray squirrel, brush rabbit, black-tailed jackrabbit, wildcat, and coyote, as well as red-tailed hawks, woodpeckers, and numerous other nongame birds.

These various kinds of wildlife occupy a number of different kinds of habitat whose quality depends on many factors besides the characteristics of the soils. Nevertheless, the soils and their inherent fertility are most important because they limit the quality of a habitat for any particular kind of wildlife through their effect on the plants that provide food and cover.

Wildlife suitability groups

To facilitate the discussion of wildlife-soil relationships and of the factors that can be manipulated to improve food and cover for wildlife, the soils of the survey area have been grouped in wildlife suitability groups. Each group consists of soils that have similar suitability and that produce the same general type of habitat. Although the relationship between soils and wildlife is not always clear, it is known that the kinds of plants that grow on the soils are important to wildlife. Therefore, the discussions of the wildlife suitability groups includes the names of the principal kinds of plants that grow on the soils of the group. In addition, table 4 shows the suitability of selected plants for the soils of the various wildlife groups and indicates the importance of these plants to stated kinds of wildlife that inhabit the survey area.

The wildlife suitability groups are discussed in the following pages. To find the names of all the soils in each group, refer to the "Guide to Mapping Units" at the back of this survey.

WILDLIFE SUITABILITY GROUP 1

This group consists of soils on wet alluvial flood plains and in basins at elevations of 350 to 500 feet. The soils are nearly level to gently sloping and are poorly drained or somewhat poorly drained loams to clays.

The vegetation varies with the degree of wetness and the use of the soils. In undisturbed areas the cover ranges from tules and cattails in the wetter spots to grass and weedy plants in the drier areas. Scattered willows and cottonwoods grow throughout the areas.

The wetter areas of these soils are used by wood ducks, mallards, and raccoons and by such nongame species as meadowlarks and blackbirds. The drier areas provide cover for a few ring-necked pheasants, California quail, and cottontail rabbits. Most areas of these soils are suitable for fish ponds and duck ponds, but flooding in winter somewhat limits the use of these soils for that purpose.

WILDLIFE SUITABILITY GROUP 2

This group consists of deep soils on flood plains, on bottom land, and on low to intermediate terraces at elevations ranging from 350 to 2,000 feet. The soils are level to gently undulating and are moderately well drained to excessively drained loamy sands to loams. This group of soils is among the most productive in the survey area. The vegetation in undisturbed areas is grasses and forbs and some scattered oak and cottonwood trees. Many areas of these soils are irrigated and are used for orchards, alfalfa, grain, and irrigated pasture.

These soils are well suited to plants that can provide food and cover for California quail, mourning doves, and ring-necked pheasants. Deer are mainly on the uplands or in river bottoms adjacent to these soils, but they feed in orchards and irrigated pasture on these soils, and thus cause damage. Shooting preserves can be developed on these soils, and the slowly permeable nearly level soils are suitable for construction of fish and duck ponds.

WILDLIFE SUITABILITY GROUP 3

This group consists of sandy loams on terraces, fans, and uplands surrounding the main valley at elevations ranging mostly from 500 to 2,000 feet. These soils are nearly level to very steep and moderately well drained to excessively drained. They are rocky in many places. They are very shallow to hardpan or bedrock. A few areas are hummocky, and the low areas are ponded in wet periods. Available water capacity is low.

The vegetation generally is annual grasses, such as soft chess, and annual forbs, such as filaree, popcorn flower, lupine, Spanish clover, and fiddleneck. A few scattered blue oak or Digger pine grow on hummocks or on the deeper pockets of soil. Some buckbrush, ceanothus, and manzanita grow near these trees. Less than 5 percent of the surface cover is woody vegetation.

These soils have limited use as wildlife habitat because of their sparse plant cover. Jackrabbits, meadowlarks, horned larks, and mourning doves frequent the areas. Pipits, broad-winged hawks, and eagles use the areas extensively in winter. Columbian black-tailed deer use the wooded areas to a limited extent in winter. California quail live along the edges of the areas if trees are nearby.

Grazing by cattle influences the amount of food produced for wildlife on these soils because grazing reduces the grasses and thus increases the percentage of seed-producing forbs that make up the plant cover. Overgrazing encourages vinegar weed and turkey mullein as does disking late in spring. Shrubby cover and food plots can be established, using irrigation on pockets of deeper soil, to provide a better habitat for quail. The water supply in summer is inadequate for quail on some of these soils. Fishpond development is limited because these soils are shallow.

WILDLIFE SUITABILITY GROUP 4

This group consists of soils that are extensive in the Bald Hills area at elevations ranging from 500 to 2,000 feet. The soils are nearly level to very steep and are well-drained or moderately well drained mostly clay loams to

[5] By WENDELL MILLER, biologist, assisted by DWIGHT ELLISON, soil scientist, Soil Conservation Service.

TABLE 4. *Suitability of plants for soils in wildlife*

[Numerals in columns have the following meaning: 1, plants are well suited to the soils, and they are choice food for wildlife; 2, plants
plant is not suited to the soils, that its suitability

Plants	Suitability of plants for soils of —							
	Wildlife group 1	Wildlife group 2	Wildlife group 3	Wildlife group 4	Wildlife group 5	Wildlife group 6	Wildlife group 7	Wildlife group 8
Alfalfa		1						
Barley	2	1		1	2		2	
Brodiaea		1	2	1	1	2		
Buckbrush			2		1	1		2
Burclover	2	1	2	1	1	2	2	
California hedge parsley		2	1	1	1	2		2
Chamise			2		2	1		2
Coffeeberry			2		1	1		2
Deerbrush			2		1	1		2
Fiddleneck	2	1	2	1	1	2	2	
Filaree	2	1	2	1	1	2	2	
Gooseberry		1			1	2		2
Lupine, annual		2	1	1	1	2		2
Manzanita, green-leaf						2		1
Melicgrass				2	1	2	2	2
Mountain mahogany, western					2	2		2
Oak, black								1
Oak, blue		1			1	2		
Oak, interior live		1			1			
Oak, valley		1			2			
Pine, ponderosa								1
Pine, sugar								1
Popcorn flower		1	2	1	1	2	2	2
Pyracantha		1			2			
Rose, California	2	1		2	1		2	
Rose, multiflora	2	1			2			
Silktassel					1	1		2
Soft chess	2	1	2	1	1	2	2	
Spanish clover				2	1	1		2
Toyon		2		2	1	1		
Turkey mullein		1	2	1	1	2	2	
Vetch, Lana	2	1		1	1			
Wheat	2	1		1	2		2	
Wild oats	2	1		1	1	2	2	
Willow herb							2	1

silty clays. Some areas are very stony. They are shallow to or deep over bedrock or they formed in very deep alluvium.

The vegetation generally is annual grasses and forbs and perennial grasses and a few blue oak. Less than 5 percent of the surface cover is woody vegetation. These soils are used for dryland pasture and range.

These soils provide a cover of grasses for jackrabbits, meadowlarks, horned larks, and mourning doves. They furnish plants that provide food for quail but do not provide sufficient shrubby cover to be used extensively by quail or deer. Wildlife habitat on these soils can be improved for deer and quail by the establishment of more trees and shrubs on the deeper, more level soils, where weed competition can be reduced by cultivation and where some irrigation water can be supplied during the first 2 years of establishment.

Grazing by cattle increases the percentage of seed-producing annual forbs. The food supply for doves, quail, and deer on such sites can be increased by planting Lana vetch. Pheasants are not common, but sufficient cover for shooting preserves can be produced, particularly where irrigation water is available. Fish ponds can be readily constructed where suitable dam sites exist.

WILDLIFE SUITABILITY GROUP 5

This group consists of soils on foot slopes and terraces surrounding valleys throughout much of the survey area at elevations ranging from 500 to 3,500 feet. The soils are nearly level to very steep and are moderately well drained to excessively drained sandy loams to clay loams. They are shallow to deep. Available water capacity generally is low. The plant production potential is very low to moderate.

The vegetation generally is grass-oak on rangeland. Cover ranges from open grassland with scattered oaks to stands of oaks that have an understory of brush and grass. From 5 to 80 percent of the surface cover is woody vegetation. A few Douglas fir and ponderosa pine grow at higher

groups and their importance to stated kinds of wildlife

are fairly well suited to the soils and they will be eaten by wildlife if choice plants are not available. Dashes in columns mean that the is not known, or that it is seldom used by wildlife]

Suitability of plants for soils of—Continued		Suitability of plants as food for—								
Wildlife group 9	Wildlife group 10	Deer	Bear	Squirrel	Band-tailed pigeon	Dove	Valley quail	Mountain quail	Pheasant	Wood duck
--	--	1	--	--	--	--	1	--	2	--
--	--	2	--	--	1	2	1	--	1	1
--	2	1	--	--	--	--	--	1	--	--
2	2	1	--	--	2	--	1	1	--	--
--	2	2	--	--	--	--	1	2	2	--
--	2	--	--	--	--	--	2	1	--	--
--	--	1	--	--	--	--	2	2	--	--
--	2	2	1	--	1	--	2	2	--	--
--	2	1	2	--	2	--	2	1	--	--
--	2	--	--	--	--	2	1	1	2	--
--	--	2	--	--	--	2	1	1	2	--
--	2	2	2	--	2	--	1	2	--	--
--	2	2	--	--	--	2	1	2	--	--
1	--	2	1	--	2	--	2	2	--	--
--	--	2	--	--	--	--	--	2	--	--
2	--	1	--	--	--	--	2	2	--	--
2	2	1	2	1	1	--	2	2	--	1
--	2	1	2	1	1	--	1	1	--	1
--	--	1	2	1	1	--	1	1	--	1
--	--	1	2	1	1	--	2	--	--	1
2	--	--	--	1	2	--	2	1	--	--
2	--	--	2	1	2	--	2	1	--	--
--	2	2	--	--	--	2	1	2	2	--
--	--	--	--	--	2	--	1	2	1	--
--	2	2	1	--	--	--	1	2	2	--
--	--	1	--	--	--	--	--	--	1	--
2	--	1	1	--	1	--	--	1	--	--
--	2	1	--	--	--	--	1	2	2	--
--	2	2	--	--	--	2	1	1	--	--
--	2	1	2	--	2	--	1	1	2	--
--	2	--	--	--	--	1	1	1	--	--
--	--	1	--	--	2	1	1	--	2	--
--	--	2	--	--	1	1	1	1	1	1
--	2	2	--	--	--	2	2	2	1	2
2	2	2	--	--	--	--	--	1	--	--

elevations. The main use is range, but some areas are used for dryland pasture, watershed, and field crops.

These soils are well suited to plants that can provide food and cover for California quail, deer, and mourning doves. Band-tailed pigeon, gray squirrel, and mountain quail also frequent this habitat. Wild pigs are mainly south of Cow Creek, and a few Rocky Mountain elk are in the northeastern part of the survey area. Nongame birds include woodpeckers, jays, towhees, and red-tailed hawks. Wildlife habitat on these soils can be developed and improved, particularly on the more gently sloping soils. Economic returns from the leasing of trespass rights for hunting are likely to be very good.

WILDLIFE SUITABILITY GROUP 6

This group is at elevations of 750 to 3,000 feet. The soils are sloping to very steep loams and are stony or rocky. They are shallow to bedrock. Available water capacity is low or very low.

The vegetation generally is Chaparral; but it includes such species as chamise, Brewer's oak, Lemon's ceanothus, buckbrush, toyon, poison oak, Yerda santa, whiteleaf manzanita, and western mountain mahogany are also present. A few trees, such as interior live oak and Digger pine, also grow in these areas. About 80 percent or more of the surface cover is woody vegetation.

These soils are suited to plants that can provide food and cover for black-tailed deer, mountain and California quail, and brush rabbit, as well as choice food for band-tailed pigeon and black bear. Nongame birds include towhees, brushtits, and scrub jays. The slope and shallowness of the soils limit the degree to which the wildlife habitat can be developed and improved. These properties also impose limtiations on fishpond construction. Sites for browse, trails, and roads are largely limited to the more gently sloping soils on benches and ridges. These soils are suitable for recreation and leasing of hunting rights for deer, quail, wild pig, and band-tailed pigeon.

WILDLIFE SUITABILITY GROUP 7

This group consists of soils that formed in alluvium in valleys at elevations of 1,500 to 5,500 feet. These soils are mainly in the mountain valleys in the eastern part of the survey area and are adjacent to soils under forest vegetation. They are nearly level to gently sloping. They have a surface layer of loam or clay loam and a subsoil of clay loam or clay. A water table is at a depth of 5 feet or less in many places. Available water capacity is high.

The vegetation is grasses, sedges, spikerushes, and wiregrass. Less than 5 percent of the surface cover is woody vegetation. These soils are suited to irrigated pasture and meadow development and are suited to adapted plant species. The high water table limits the growth of trees on these soils.

These soils are suited to plants that can provide food for deer, quail, and waterfowl. They can be developed for fishponds and trout hatchery production. The small acreage limits the potential for extensive development of duck ponds.

WILDLIFE SUITABILITY GROUP 8

This group is the largest wildlife suitability group in the survey area. The soils are at elevations of 1,000 to 7,000 feet. Characteristics and qualities of the soils in this group vary greatly. The soils range from nearly level to very steep and from loamy sand to clay loam. Some of the soils are gravelly, stony, or rocky. Depth to bedrock ranges from about 1 foot to more than 6 feet. Available water capacity is low to very high.

The vegetation generally is a dense stand of trees that has little or no understory, open stands of trees that have an understory of shrubs and grasses, or single trees in a stand of brush. Trees include sugar pine, ponderosa pine, incense cedar, Douglas-fir, knobcone pine, black oak, and canyon live oak. Common species of brush are whiteleaf manzanita, California coffeeberry, deer brush, mountain misery, snowberry, mountain whitethorn, and redbud. From 20 to more than 80 percent of the surface cover is woody vegetation.

These soils are suited to plants that provide food and cover for black-tailed deer, band-tailed pigeon, mountain quail, black bear, and gray squirrel. A few blue grouse and a few Rocky Mountain elk, which were introduced in 1916, are in the northeastern part. Nongame birds include woodpeckers, chickadees, and nuthatches. In general, more open and intermingled stands provide a better habitat for wildlife than mature stands of trees that have a closed canopy. Therefore, wildlife habitat on these soils can be improved by thinning and pruning to open up the immature stands.

WILDLIFE SUITABILITY GROUP 9

This group is at elevations of 3,000 to 7,000 feet. The soils are nearly level to very steep and are loamy sands or sandy loams. They are stony or rocky and are shallow to bedrock. Available water capacity is low or very low. These soils are suitable for only a limited number of plants.

The vegetation generally is greenleaf manzanita, chinquapin brush, huckleberry oak, and pine mat. These plants make up most of the cover in areas where 80 percent or more of the surface cover is woody vegetation.

These soils have limited use as wildlife habitat. They provide habitat mainly for deer and a few songbirds in summer. These soils are poorly suited to development or improvement of wildlife habitat.

WILDLIFE SUITABILITY GROUP 10

This group consists of land types that are made up of Riverwash and of areas that have been mined for gold by placer mining or dredging. Streams, reservoirs, and ponds are available.

In general, vegetation is sparse on the areas that have been mined, and they are poorly suited to wildlife habitat. In time the cover can be improved. Mulching, fertilizing, and seeding or planting to choice plants for wildlife is practical in places. In most places, a wildlife technician needs to evaluate each area.

Areas of Riverwash along live streams generally have a potential for spawning areas for steelhead and salmon. Also, streams that have a surface temperature of 70° F. or less in summer are suitable for trout.

The ponds and reservoirs have good potential for producing fish and providing habitat for waterfowl and wood ducks. Ponds and reservoirs that remain at or near 70° F. in summer are suitable for trout. Warm-water species, such as black bass, bluegill, red-eared sunfish, and catfish, do well in water that is above 70° F. Well-stocked and managed ponds have good economic potential for recreational fishing or fish production.

Engineering Uses of the Soils

This section is useful to those who need information about soils that are used as structural material or as foundations upon which structures are built. Some of those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are slope and depth to the water table and to bedrock. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section is helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or topsoil.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built to predict performance of structures on the same or similar kinds of soil in other locations.
6. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5, 6, and 7, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering or nonfarm uses; and results of engineering laboratory tests on soil samples. This information, along with the soil map and other parts of this survey, can be used to make interpretations in addition

to those given in the tables. It also can be used to make other useful maps.

It is not intended that information in this section eliminate the need for onsite sampling and laboratory testing. The information contained in this section should be used primarily in planning more detailed field investigations on the site proposed for construction. Additional information useful in engineering can be obtained from the soil map and from other parts of the survey, especially the sections "Descriptions of the Soils" and "Formation and Classification of the Soils." By using the information in this soil survey, the engineer can concentrate on the most suitable soils for engineering purposes. Then a minimum number of soil samples will be needed for laboratory testing and an adequate investigation can be made at minimum cost.

Some of the terms used by the soil scientist may be unfamiliar to the engineer, and some words may have a special meaning in soil science. These and other special terms used in this survey are defined in the Glossary according to their meaning in soil science.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*18*) used by the SCS engineers, Department of Defense, and others, and the AASHO system (*1*) adopted by the American Association of State Highway Officials. The two classification systems are also described in detail in the "Earth Manual" (*19*).

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, ML–CL.

The AASHO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 7; the estimated classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

Estimated soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 5. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. Although the profiles are considered typical, they are by no means without variation. Therefore, caution should be used in applying the information. The estimates are based on field observations made in the course of mapping, on test data for these similar soils, and on experience with the same kinds of soil in other counties. Explanations of some of the columns in table 5 are in the following paragraphs.

Depth to bedrock is the depth from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is the depth from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Each classification system uses different limits or characteristics to define the terms "gravel," "sand," "silt," and "clay." Soil texture is described in table 5 in the standard terms used by the U.S. Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." Rock fragments larger than 3 inches in diameter were not considered in arriving at the values shown in the grain-size distribution columns. Soils that contain fragments of rock are identified in the column showing USDA texture by the words "cobbly," or "stony." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey. More complete information can be obtained from the Soil Survey Manual (*14*).

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 5, but in table 7 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of soil in place in the field. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants. Estimates of available water capacity in table 5 are based on the texture, porosity, density, and structure of the soils.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

TABLE 5.—*Estimated soil*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil, which may column. The sign> means greater than; the sign< means less than. Absence of data indicates that the soil is too variable to be rated

Soil series and map symbols	Depth to— Bedrock or hardpan	Depth to— Seasonal high water table	Depth from surface of typical profile	Classification: USDA texture	Classification: Unified	Classification: AASHO	Percentage greater than 3 inches (see also remarks column)	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	Percentage less than 3 inches passing sieve— No. 10 (2.0 mm.)
	Feet	*Feet*	*Inches*						
Aiken: AaB, AaC, AaD, AbB, AbC, AbD, AcE.	>5	(1)	0–24	Clay loam	ML	A–5	--------	100	100
			24–66	Clay	MH	A–7	--------	100	100
Anderson:									
Ad	>5	(1)	0–24	Gravelly sandy loam	SM	A–2	0–5	85–90	50–75
			24–60	Very gravelly sand	GM–GP or GM	A–1	0–20	40–60	30–50
Ae	>5	(1)	0–24	Gravelly sandy loam	SM	A–2	0–5	85–90	50–75
			24–60	Consolidated alluvium	--------	--------	--------	--------	--------
Anita: AhB, AkB	1–3½	1–3½	0–22	Gravelly clay	CH	A–7	--------	85–90	60–75
			22	Cemented tuff.					
Auberry: AlB, AlD, AlF.	1½–4	(1)	0–22	Loam	ML	A–4	--------	100	95–100
			22–27	Clay loam	CL	A–6	--------	100	95–100
			27	Decomposed granite	--------	--------	--------	--------	--------
Auburn:[3] AnB, AnD, ArD, AsD2, AtE2, AuF2.	1–2½	(1)	0–27	Gravelly clay loam	ML or CL	A–4 or A–6	--------	65–100	60–85
			27	Metabasic rock	--------	--------	--------	--------	--------
Behemotosh: BeD, BeE2, BhF2.	1½–4½	(1)	0–16	Gravelly loam	CL or ML	A–4 or A–6	--------	70–85	70–85
			16–24	Very cobbly clay loam.	CL	A–6	--------	70–85	70–85
			24	Rhyolite.					
Boomer: BkC, BkD, BkE, BlF, BoE3, BoF3.	3½–>5	(1)	0–23	Gravelly clay loam	CL	A–6	3–15	75–85	65–80
			23–45	Clay loam	CL	A–6	--------	100	90–100
			45	Weathered greenstone	--------	--------	--------	--------	--------
Chaix: CaE3, CaF3, CbD2, CbE, CbF.	1½–3½	(1)	0–26	Sandy loam	SM	A–2	--------	95–100	75–95
			26	Weathered granite.					
Churn:									
CcA, CcB, CdA	>5	(1)	0–13	Loam	ML or CL	A–4	--------	90–100	85–95
			13–60	Clay loam	CL	A–6	--------	90–100	85–95
CeA, CeB, CfA, CfB	>5	(1)	0–13	Gravelly loam	SM or SC	A–4	--------	70–85	60–70
			13–60	Gravelly clay loam	CL	A–6	--------	80–90	60–70

See footnotes at end of table.

properties significant to engineering

have different properties. For this reason the reader should follow carefully the instructions for referring to another series in the first or that no estimate was made]

Percentage less than 3 inches passing sieve—Continued		Atterberg values		Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel	Remarks
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index						
				Inches per hour	*Inches per inch of soil*	*pH value*			
80–95	60–75	40–50	5–10	0.63–2.0	0.11–0.13	5.6–6.5	Low	High.	10 to 20 percent of material in units AbB, AbC, and AbD is greater than 3 inches; 20 to 35 percent in unit AcE is greater than 3 inches.
90–100	75–95	50–60	15–25	0.2–0.63	0.17–0.19	5.1–6.0	Moderate	High.	
45–60	15–25	---	[2] NP	2.0–6.3	0.07–0.09	5.6–6.5	Low	Low.	
25–35	5–15	---	NP	>20.0	0.03–0.05	5.6–6.5	Low	Low.	
45–60	15–25	---	NP	2.0–6.3	0.07–0.09	5.6–6.5	Low	Low.	
---	---	---	---	0.06–0.2	---	5.6–6.5	---	---	
55–60	50–65	50–60	25–35	0.06–0.2	0.12–0.14	6.1–8.4	High	High.	3 to 10 percent of material greater than 3 inches in unit AkB is on the surface.
80–95	60–75	25–35	0–10	0.63–2.0	0.16–0.18	5.6–7.3	Moderate	Moderate.	
80–90	70–80	30–40	15–25	0.2–0.63	0.19–0.21	4.5–5.5	Moderate	High.	
---	---	---	---	---	---	4.5–5.5	---	---	
55–70	50–60	30–40	5–15	0.63–2.0	0.17–0.19	5.6–6.5	Low	Moderate.	3 to 15 percent of material in units ArD and AtE2 is greater than 3 inches.
---	---	---	---	---	---	6.1–6.5	---	---	
60–70	50–60	20–30	5–15	0.63–2.0	0.14–0.16	5.1–6.5	Low	Moderate.	25 to 50 percent of material in upper 16 inches of units BeD and BeE2 is greater than 3 inches; 25 to 50 percent of material between 16 and 24 inches in all units is greater than 3 inches.
65–75	60–70	30–40	15–25	0.2–0.63	0.10–0.12	4.5–6.0	Low	High.	
60–75	55–65	30–40	15–25	0.2–0.63	0.14–0.16	5.1–6.5	Moderate	Low.	Material greater than 3 inches was in units BIF, BoE3, and BoF3. Bedrock at a depth of 1½ to 3½ feet in units BoE3 and BoF3.
85–95	65–75	30–40	15–25	0.2–0.63	0.19–0.21	5.1–6.5	Moderate	Moderate.	
---	---	---	---	---	---	5.1–6.5	---	---	
50–65	25–35	---	NP	2.0–6.3	0.11–0.15	5.1–7.3	Low	Low.	
75–85	50–60	20–30	0–10	0.63–2.0	0.16–0.18	5.1–6.0	Moderate	Moderate.	Seasonal high water table at a depth of 4 to more than 5 feet in unit CdA.
85–95	65–75	25–35	10–20	0.2–0.63	0.19–0.21	5.1–6.0	Moderate	Moderate.	
50–60	35–45	20–30	0–10	0.63–2.0	0.13–0.15	5.1–6.0	Low	Low.	Permeability for units CfA and CfB in the 13- to 60-inch layer is 0.06–0.2.
55–65	50–60	25–35	10–20	0.2–0.63	0.16–0.18	5.1–6.0	Moderate	Moderate.	

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to— Bedrock or hardpan	Depth to— Seasonal high water table	Depth from surface of typical profile	Classification — USDA texture	Classification — Unified	Classification — AASHO	Percentage greater than 3 inches (see also remarks column)	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	Percentage less than 3 inches passing sieve— No. 10 (2.0 mm.)
	Feet	*Feet*	*Inches*						
Clough: CgB	1½–2½	[1]	0–18	Gravelly loam	SM or SC	A–4		70–85	55–65
			18–29	Very gravelly clay and clay loam.	GC	A–2		40–60	30–50
			29–44	Strongly cemented hardpan.					
			44–60	Stratified old mixed alluvium.			0–50		
Cobbly alluvial land: Ch, Ck. Too variable for valid estimates.									
*Cohasset: ClD, CmD, CmE, CnF, CoE, CpD, CrD, CrE, CrG. For Aiken part of unit CpD, see Aiken series; for McCarthy part of units CrD, CrE, and CrG, see McCarthy series.	2–>5	[1]	0–27	Loam	CL	A–6	0–50	100	90–100
			27–53	Gravelly clay loam	CL	A–6	0–50	75–85	70–80
			53–68	Very cobbly clay loam.	CL	A–6	30–50	75–85	70–80
Colluvial land: CsF. Too variable for valid estimates.									
Cone: CtC, CtD, CuD, CvE, CwF.	>5	[1]	0–58	Gravelly loam	SM	A–2	0–15	70–80	55–65
			58–80	Cinders					
Corbett: CxE, CxF3, CxG, CyG.	1½–3½	[1]	0–24	Loamy coarse sand	SM	A–2		100	95–100
			24	Weathered granite					
Diamond Springs: DfD2, DgE2, DgE3.	1½–5	[1]	0–15	Sandy loam	SM	A–2 or A–4	3–15	100	90–100
			15–29	Sandy clay loam	SC	A–6		100	90–100
			29–54	Sandy loam	SM	A–2 or A–4		100	90–100
			54	Weathered metadacite					
Forward: FaD, FaE, FdD.	1½–4	[1]	0–22	Sandy loam and loamy sand.	SM	A–2		100	90–100
			22	Weakly cemented tuff.					
Gaviota: GaC, GaD, GbD, GbE2.	½–1½	[1]	0–17	Sandy loam	SM	A–2		95–100	90–95
			17	Hard sandstone.					
Goulding: GdD, GeE2, GeF2.	1–2	[1]	0–16	Gravelly loam	SM	A–4	3–15	65–75	60–70
			16	Fractured greenstone.					
Gravel pits: Gp. Too variable for valid estimates.									

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—Continued		Atterberg values		Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel	Remarks
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index						
				Inches per hour	*Inches per inch of soil*	*pH value*			
50–60	35–45	20–30	0–10	0.63–2.0	0.13–0.15	5.1–6.0	Low	Moderate.	
25–40	20–35	50–60	25–35	0.06–0.2	0.08–0.10	4.5–5.0	Low	Moderate.	
----------	----------	----------	----------	<0.06	----------	4.5–5.0	----------	----------	
85–95	70–80	20–30	10–20	0.63–2.0	0.15–0.17	5.1–6.5	Moderate	Moderate.	
65–75	50–65	30–40	20–30	0.63–2.0	0.16–0.18	4.5–6.0	Moderate	Moderate.	
65–75	50–65	30–40	20–30	0.63–2.0	0.12–0.14	4.5–5.5	Low	Low.	
40–50	25–35	----------	NP	6.3–20.0	0.13–0.15	5.6–7.3	Low	Low.	Material greater than 3 inches was on the surface
----------	----------	----------	----------	6.3–20.0	----------	5.6–7.3			
50–75	15–30	----------	NP	6.3–20.0	0.08–0.10	5.1–6.5	Low	Low.	
60–70	30–40	----------	NP	2.0–6.3	0.11–0.13	4.5–6.0	Low	Low.	Material greater than 3 inches was on the surface.
80–90	35–50	20–30	10–20	0.63–2.0	0.14–0.16	5.1–6.0	Low	Moderate.	
60–70	30–40	----------	NP	2.0–6.3	0.11–0.13	5.1–5.5	Low	Moderate.	
55–65	20–30	----------	NP	2.0–6.3	0.09–0.11	5.1–6.5	Low	Low.	
60–70	25–35	----------	NP	2.0–6.3	0.11–0.15	5.6–6.5	Low	Low.	
50–60	35–45	20–30	0–10	0.63–2.0	0.13–0.15	5.6–6.5	Low	Low.	Material greater than 3 inches was on the surface of unit GaD.

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to— Bedrock or hardpan	Seasonal high water table	Depth from surface of typical profile	Classification: USDA texture	Unified	AASHO	Percentage greater than 3 inches (see also remarks column)	Percentage less than 3 inches passing sieve: No. 4 (4.7 mm.)	No. 10 (2.0 mm.)
	Feet	*Feet*	*Inches*						
Guenoc: GsD, GuD, GvE.	1½–3½	(1)	0–5	Very stony loam	SM	A–4	3–15	70–80	60–70
			5–23	Very cobbly clay loam.	CL	A–6	15–50	90–100	90–100
			23	Andesite.					
Henneke: HaF	1–2	(1)	0–10	Loam	ML or CL	A–4		90–100	85–95
			10–16	Very stony clay loam.	GM or SM	A–2 or A–4	20–45	40–70	35–65
			16	Serpentine.					
Hillgate: Hb	>5	(1)	0–8	Loam	ML or CL	A–4 or A–6		95–100	95–100
			8–65	Clay	CL	A–7		95–100	95–100
Holland: HcE, HcF	3½–>5	(1)	0–6	Sandy loam and loam.	SM or ML	A–4		90–100	90–100
			6–34	Clay loam	CL	A–6		90–100	90–100
			34–60	Loam	ML or CL	A–4		90–100	85–95
Honcut:									
Hd, He	>5	(1)	0–60	Loam (gravelly loam surface layer in unit He).	ML or CL	A–4		90–100	70–95
Hf	>5	(1)	0–40	Gravelly loam	SM	A–4		75–85	70–80
			40–60	Very gravelly loam	GM	A–1		45–55	40–50
Honn: HgA, HgB, HhA	>5	(1)	0–17	Gravelly sandy loam (fine sandy loam in places).	SM	A–2		65–85	60–75
			17–46	Gravelly sandy clay loam.	SC	A–2		65–85	60–75
			46–60	Very gravelly sandy clay loam.	GC	A–2		40–55	35–45
Igo: IaB	¼–1	(1)	0–7	Gravelly loam	SM or SC	A–4 or A–6		75–85	70–80
			7–22	Indurated hardpan					
			22–60	Stratified mixed alluvium.			0–50		
*Inks: IbD, IdD, IdE, IeD, IeE. For Pentz part of units IeD and IeE, see Pentz series.	1–1½	(1)	0–14	Loam and gravelly loam.	SM or SC	A–4 or A–6	0–15	60–90	50–80
			14–19	Very gravelly clay loam.	GC	A–2		30–60	20–50
			19	Tuff.					
Jiggs. Jiggs soils are mapped only in complex or undifferentiated group with Lyonsville soils.	1½–5	(1)	0–23	Gravelly sandy loam	SM	A–2		65–85	60–75
			23	Fractured dacite.					

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—Continued		Atterberg values		Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel	Remarks
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index						
				Inches per hour	*Inches per inch of soil*	*pH value*			
50–60	35–45	20–30	0–10	0.63–2.0	0.12–0.14	5.6–6.5	Low	Low.	
80–90	65–75	30–40	10–20	0.2–0.63	0.14–0.16	5.6–6.5	Low	Low.	
75–85	65–75	20–30	0–10	0.63–2.0	0.14–0.16	5.6–7.3	Low	Low.	
30–50	25–45	30–40	0–10	0.2–0.63	0.09–0.11	6.1–7.3	Low	Moderate.	
85–95	70–80	20–30	5–15	0.63–2.0	0.14–0.16	5.6–6.5	Moderate	Low.	
90–100	80–90	40–50	20–30	<0.06	0.04–0.06	6.1–7.8	High	High.	
65–80	40–65	5–20	0–10	0.63–2.0	0.13–0.15	5.1–6.5	Low	Low.	
85–95	65–75	30–40	10–20	0.2–0.63	0.19–0.21	4.5–6.0	Moderate	Moderate.	
75–85	65–75	20–30	0–10	0.63–2.0	0.14–0.16	4.5–5.0	Moderate	Moderate.	
60–85	50–75	20–30	0–10	0.63–2.0	0.14–0.18	5.6–6.5	Low	Low.	
60–70	40–50	20–30	0–10	0.63–2.0	0.11–0.13	5.6–6.5	Low	Low.	
30–40	20–25	20–30	0–10	6.3–20.0	0.08–0.10	5.6–6.5	Low	Low.	
50–65	15–25	--------	NP	2.0–6.3	0.10–0.15	5.6–6.5	Low	Low.	
50–65	25–35	20–30	10–20	0.2–0.63	0.11–0.16	5.6–6.0	Moderate	Moderate.	
30–40	15–25	20–30	10–20	0.63–2.0	0.07–0.09	6.1–6.5	Low	Low.	
60–70	40–50	20–30	5–15	0.63–2.0	0.11–0.13	5.1–6.5	Moderate	Moderate.	
				<0.06					
45–75	35–50	25–35	5–15	0.63–2.0	0.09–0.13	6.1–7.3	Low	Low.	
15–40	10–25	30–40	15–25	0.63–2.0	0.05–0.07	5.6–7.3	Low	Moderate.	
50–65	25–35	-------	NP	2.0–6.3	0.09–0.11	4.5–6.0	Low	High.	

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to— Bedrock or hardpan	Depth to— Seasonal high water table	Depth from surface of typical profile	Classification: USDA texture	Classification: Unified	Classification: AASHO	Percentage greater than 3 inches (see also remarks column)	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	Percentage less than 3 inches passing sieve— No. 10 (2.0 mm.)
	Feet	*Feet*	*Inches*						
*Josephine: JbD, JbE, JbF, JdD, JdE, JsF. For Sheetiron part of unit JsF, see Sheetiron series.	2->5	(1)	0-45	Gravelly clay loam	SC	A-6	--------	65-75	60-70
			45-60	Very stony clay loam	SC	A-6	10-40	65-75	60-70
			60	Shale and sandstone.					
Kanaka: KbC, KcD, KcE, KcF2.	1½-4	(1)	0-48	Sandy loam	SM	A-2 or A-4	--------	90-100	85-95
			48	Weathered granodiorite.					
Keefers: KdA, KdB, KeB.	>5	(1)	0-7	Gravelly loam	SM	A-2	0-20	60-70	50-60
			7-21	Clay loam	CL	A-6	5-20	90-100	90-100
			21-60	Very gravelly clay (weakly cemented below 26 inches).	GC	A-2	5-20	30-60	20-50
Kidd: KgF2	½-1½	(1)	0-16	Gravelly loam and very gravelly loam.	GM or GC	A-2	--------	45-55	40-50
			16	Fractured rhyolite.					
*Kilarc: KhC, KhD, KhE, KlD, KlE, KsD. For Sites part of unit KsD, see Sites series.	2-4	(1)	0-9	Sandy clay loam	SM or SC	A-4 or A-6	0-15	85-95	80-95
			9-22	Clay	CH	A-7	--------	100	95-100
			22-44	Clay loam and sandy clay loam.	CL	A-7	--------	100	100
			44	Weakly consolidated sandstone.					
Landslides: LaE. Too variable for valid estimates.									
Lodo: LbE, LbF3	½-1	(1)	0-10	Shaly loam	SM or SC	A-4 or A-6	--------	80-90	60-80
			10	Shale.					
Los Robles: LcA, LcB, LdA, LeB, LfA.	>5	(1)	0-65	Loam and heavy loam (gravelly in places).	CL or SC	A-6	--------	75-100	60-100
*Lyonsville: LgE, LhE, LkF. For Jiggs part of these units, see Jiggs series.	2-5	(1)	0-33	Gravelly sandy clay loam.	SM or SC	A-2	3-10	70-80	65-75
			33	Weathered dacite.					
Marpa: MaE, MaG	1½-3½	(1)	0-13	Gravelly heavy loam	CL	A-6	--------	75-90	60-75
			13-26	Very gravelly clay loam.	GC	A-2	--------	30-60	20-50
			26	Fractured shale.					
Maymen: MbG2	½-1½	(1)	0-13	Gravelly loam	SM or SC	A-2	3-15	80-90	60-75
			13	Shale.					
McCarthy. McCarthy soils are mapped in complexes or undifferentiated groups with Cohasset or Windy soils.	3½-5	(1)	0-20	Gravelly sandy loam	SM	A-2	1-3	65-85	60-75
			20-44	Very cobbly sandy loam.	GM	A-1	35-50	45-55	40-50
			44	Basalt.					

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—Continued		Atterberg values		Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel	Remarks
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index						
				Inches per hour	*Inches per inch of soil*	*pH value*			
45–55	35–50	30–40	15–25	0. 63–2. 0	0. 15–0. 17	5. 1–6. 5	Moderate	Moderate.	
45–55	35–50	30–40	15–25	0. 63–2. 0	0. 11–0. 13	5. 1–6. 0	Low	Moderate.	
55–65	30–40	--------	NP	2. 0–6. 3	0. 11–0. 13	4. 5–6. 0	Low	Low.	
45–55	25–35	25–35	0–10	0. 63–2. 0	0. 11–0. 13	5. 6–6. 5	Low	Low.	
80–90	50–60	30–40	20–30	0. 2–0. 63	0. 13–0. 15	5. 6–7. 3	Moderate	Moderate.	
15–40	15–25	50–60	20–30	0. 06–0. 2	0. 05–0. 09	6. 1–6. 5	Low	High.	
30–40	25–35	25–35	5–15	2. 0–6. 3	0. 11–0. 13	4. 5–6. 0	Low	Low.	
65–75	35–50	25–35	5–15	0. 2–0. 63	0. 14–0. 16	5. 6–6. 5	Moderate	Moderate.	
90–100	75–85	60–70	35–45	0. 06–0. 2	0. 14–0. 16	4. 0–5. 0	High	High.	
90–100	70–80	40–50	20–30	0. 2–0. 63	0. 19–0. 21	4. 0–5. 0	Moderate	Moderate.	
55–75	35–50	25–35	5–15	0. 63–2. 0	0. 08–0. 10	5. 6–7. 3	Low	Low.	
55–95	45–65	25–35	10–20	0. 2–0. 63	0. 15–0. 19	5. 6–7. 3	Moderate	Low.	Bedrock at depth of 2 to 4 feet in unit LeB. Available water capacity is 0.13–0.15 in unit LeB.
55–65	25–35	25–35	5–15	0. 63–2. 0	0. 10–0. 12	4. 5–6. 5	Low	Moderate.	Material greater than 3 inches was on the surface.
55–65	50–60	25–35	10–20	0. 63–2. 0	0. 15–0. 17	5. 6–6. 5	Low	Low.	
15–40	10–25	30–40	15–25	0. 63–2. 0	0. 10–0. 12	5. 1–5. 5	Low	Moderate.	
55–75	25–35	20–30	5–15	0. 63–2. 0	0. 12–0. 14	5. 1–6. 5	Low	Low.	Material greater than 3 inches was on the surface.
50–65	15–25	--------	NP	2. 0–6. 3	0. 07–0. 09	5. 6–6. 5	Low	Low.	Material greater than 3 inches was on the surface.
30–40	15–25	--------	NP	2. 0–6. 3	0. 05–0. 07	5. 6–6. 5	Low	Low.	

TABLE 5. *Estimated soil properties*

Soil series and map symbols	Depth to— Bedrock or hardpan	Depth to— Seasonal high water table	Depth from surface of typical profile	Classification: USDA texture	Classification: Unified	Classification: AASHO	Percentage greater than 3 inches (see also remarks column)	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	Percentage less than 3 inches passing sieve— No. 10 (2.0 mm.)
	Feet	*Feet*	*Inches*						
Millsap: McD, McE, McG, MdE.	1½–3½	(1)	0–11	Loam	CL	A–6		95–100	90–100
			11–33	Silty clay	CH	A–7		100	95–100
			33	Sandstone and shale.					
Millsholm: MeD, MeD2, MeE, MeG, MfE2, MfF2.	½–1½	(1)	0–16	Gravelly loam	SC	A–2		65–85	60–80
			16	Sandstone and conglomerate.					
Moda: MgA, MhA, MkB.	1–3	(1)	0–19	Loam	ML or CL	A–4 or A–6		90–95	85–95
			19–24	Clay	CH or MH	A–7		90–95	85–95
			24–39	Hardpan					
			39–60	Mixed old stratified alluvium.			0–50		
Molinos: Mm, Mn, Mo.	>5	(1)	0–70	Fine sandy loam	SM or ML	A–4		100	100
Myers: MrA, MrB	>5	(1)	0–54	Silty clay	CH	A–7		100	100
			54–64	Gravelly silty clay loam.	CL	A–7		80–100	75–100
*Nanny: NaB, NbB, NcB. For Windy part of unit NcB, see Windy series.	>5	(1)	0–20	Stony and gravelly sandy loam.	SM	A–2	0. 15	65–85	60–75
			20–66	Very cobbly sandy loam.	SM–SP or SM	A–1	35–50	65–85	60–70
Neuns: NdE, NdG	1½–3½	(1)	0–13	Very stony loam and gravelly silty clay loam.	SC	A–6	3–15	65–85	60–75
			13–23	Very gravelly silty clay loam.	GC	A–2		30–60	20–50
			23	Greenstone.					
Newtown: NeC, NeD, NeE2, NfE2.	>5	(1)	0–8	Gravelly loam	SM	A–1 or A–2	1–3	65–75	50–60
			8–18	Very gravelly clay loam.	GC	A–2		40–60	35–50
			18–35	Clay	CL	A–6 or A–7		90–100	85–95
			35–65	Silty clay loam	CL	A–6		90–100	90–100
Parrish: PcD, PcE, PcF.	1½–3½	(1)	0–9	Loam	ML or CL	A–4 or A–6		95–100	90–100
			9–38	Gravelly heavy clay loam.	CL	A–6 or A–7		75–85	65–85
			38	Meta-andesite.					
*Pentz: PfF. For Supan part of this unit, see Supan series.	½–1½	(1)	0–18	Fine sandy loam and very gravelly sandy loam.	SM	A–1		55–70	50–65
			18	Strongly cemented tuff.					
Perkins: [4]									
PlA	>5	(1)	0–10	Loam	ML or CL	A–4 or A–6		90–100	85–95
			10–60	Clay loam	CL	A–6		90–100	90–100
PmA, PmB, PmC, PmD, PnA, PoA, PoB.	>5	(1)	0–10	Gravelly loam	SC	A–4 or A–6		80–90	70–85
			10–60	Gravelly clay loam	SC	A–6		75–90	70–85

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—Continued		Atterberg values		Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel	Remarks
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index						
				Inches per hour	*Inches per inch of soil*	*pH value*			
80–90	75–85	30–40	10–20	0. 63–2. 0	0. 16–0. 18	5. 6–6. 5	Moderate	Moderate.	
95–100	85–95	70–80	40–50	0. 06–0. 2	0. 15–0. 17	5. 6–6. 5	High	High.	
35–45	25–35	25–35	10–20	0. 63–2. 0	0. 12–0. 14	5. 1–7. 3	Low	Low.	
70–80	55–65	30–40	5–15	0. 63–2. 0	0. 16–0. 18	5. 6–6. 5	Moderate	Moderate.	
80–90	70–80	60–70	30–40	0. 06–0. 2	0. 17–0. 19	6. 1–7. 8	High	High.	
				<0. 06		7. 9–8. 4			
70–85	45–55	10–20	0–10	2. 0–6. 3	0. 13–0. 15	6. 1–7. 8	Low	Mn: low; Mm, Mo: high.	
90–100	90–100	65–75	45–55	0. 06–0. 2	0. 15–0. 17	5. 6–8. 4	High	High.	
80–100	70–85	40–50	25–35	0. 2–0. 63	0. 15–0. 21	6. 6–8. 4	Moderate	Moderate.	
50–65	15–25		NP	6. 3–20. 0	0. 07–0. 09	5. 1–6. 5	Low	Low.	
40–50	5–15		NP	6. 3–20. 0	0. 05–0. 07	4. 5–6. 0	Low	Low.	
55–65	35–45	20–35	10–20	0. 63–2. 0	0. 11–0. 13	5. 1–6. 0	Low	Low.	Material greater than 3 inches was on the surface.
15–40	10–25	35–45	15–25	0. 63–2. 0	0. 06–0. 08	5. 1–6. 0	Low	Moderate.	
35–45	20–35		NP	0. 63–2. 0	0. 12–0. 14	5. 1–6. 5	Low	Low.	Material greater than 3 inches was on the surface of unit NfE2.
30–40	25–35	20–30	10–20	0. 2–0. 63	0. 10–0. 12	5. 1–6. 5	Low	Moderate.	
70–80	50–60	35–45	15–25	0. 06–0. 2	0. 15–0. 17	5. 1–6. 5	High	High.	
65–75	50–60	20–30	10–20	0. 2–0. 63	0. 19–0. 21	5. 6–7. 3	Moderate	Moderate.	
85–95	60–70	25–35	5–15	0. 63–2. 0	0. 16–0. 18	5. 6–6. 5	Low	Low.	
60–70	50–60	35–45	15–25	0. 06–0. 2	0. 16–0. 18	5. 1–6. 5	Moderate	Moderate.	
30–45	15–25		NP	2. 0–6. 3	0. 07–0. 09	5. 6–7. 3	Low	Low.	
70–80	50–65	20–30	5–15	0. 2–0. 63	0. 16–0. 18	5. 6–6. 5	Low	Low.	Seasonal high water table at a depth of 3 to 5 feet in unit PnA. Bedrock at a depth of 2 to 3 feet in units PoA and PoB.
70–85	60–70	30–40	15–25	0. 06–0. 2	0. 14–0. 16	5. 6–6. 5	Moderate	Moderate.	
50–65	35–45	20–30	5–15	0. 2–0. 63	0. 12–0. 14	5. 6–6. 5	Low	Low.	
50–65	40–50	30–40	15–25	0. 06–0. 2	0. 10–0. 12	5. 6–6. 5	Moderate	Moderate.	

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to— Bedrock or hardpan	Depth to— Seasonal high water table	Depth from surface of typical profile	Classification — USDA texture	Classification — Unified	Classification — AASHO	Percentage greater than 3 inches (see also remarks column)	Percentage less than 3 inches passing sieve— No. 4 (4.7 mm.)	Percentage less than 3 inches passing sieve— No. 10 (2.0 mm.)
Red Bluff:	*Feet*	*Feet*	*Inches*						
RbA, RbB	>5	(1)	0–28	Light clay loam	CL	A–6	----	95–100	90–100
			28–57	Light clay	CL	A–7	----	95–100	90–100
			57–67	Clay loam	CL	A–6	----	95–100	90–100
RcA, RcB	>5	(1)	0–12	Gravelly loam	SM or SC	A–4 or A–6	----	65–85	60–80
			12–30	Gravelly clay	SC or CL	A–7	----	55–80	50–75
			30–60	Hardpan	----	----	----	----	----
*Redding: RdA, RdB, ReA, ReB. For Red Bluff part of units ReA and ReB, see units RcA and RcB of the Red Bluff series.	1–2½	(1)	0–6	Gravelly loam	SM	A–4	----	75–85	70–80
			6–13	Clay	CH or MH	A–7	----	95–100	90–95
			13–28	Hardpan	----	----	----	----	----
			28–60	Mixed old stratified alluvium.	----	----	0–50		
Reiff: [5]									
RfB, RhA	>5	(1)	0–40	Sandy loam	SM	A–2	----	100	90–100
			40–60	Very gravelly sand	GP or GW	A–1	----	40–50	30–40
RgA, RgB	>5	(1)	0–43	Fine sandy loam	SM	A–4	----	100	95–100
			43–62	Loamy fine sand	SM	A–2	----	100	95–100
RkA	>5	(1)	0–40	Gravelly fine sandy loam.	SM	A–2	----	55–80	50–75
			40–60	Very gravelly sand	GP or GW	A–1	----	40–50	30–40
RlA, RmA	>5	(1)	0–60	Loam	ML or CL	A–4	----	100	95–100
RnA, RoA	>5	(1)	0–60	Gravelly loam	SM	A–4	----	55–80	50–75
Riverwash: Rw. Too variable for valid estimates.									
Rock land: RxF. Too variable for valid estimates.									
Rubble land: RyF. Too variable for valid estimates.									
Sehorn: ScB, ScD, ScE, SdD2, SeD, SeE, SfF2.	1½–4	(1)	0–28	Silty clay and silty clay loam.	CH	A–7	3–15	95–100	95–100
			28	Weathered shale.					
Sheetiron: SgE, SgF, SgG.	1½–3½	(1)	0–22	Very gravelly loam.	GM	A–2	3–15	45–55	40–50
			22	Slate.					
Shingletown:									
SnB	3½–5	3–5	0–60	Clay loam and sandy clay loam.	CL or SC	A–6	----	95–100	90–100
SkA	>5	(1)	0–46	Loam	CL	A–6	----	90–100	90–100
			46–59	Sandy clay loam	SC or CL	A–6	----	95–100	90–100
			59–65	Gravelly clay loam	SC	A–6	----	65–75	60–70
Sierra: SmB, SmC, SmD, SmD3, SmE.	3½–>5	(1)	0–10	Sandy loam and loam	SM or ML	A–4	----	95–100	90–100
			10–43	Clay loam	ML or CL	A–6 or A–7	----	95–100	90–100
			43	Weathered granodiorite.					

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—Continued		Atterberg values		Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel	Remarks
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index						
				Inches per hour	*Inches per inch of soil*	*pH value*			
85–95	65–75	20–30	10–20	0.63–2.0	0.15–0.17	4.5–6.0	Low	Moderate.	
85–95	65–75	40–50	20–30	0.2–0.63	0.15–0.17	4.5–5.5	Moderate	High.	
85–95	65–75	30–40	10–20	0.63–2.0	0.19–0.21	5.6–6.0	Low	Moderate.	
50–65	35–50	20–30	5–15	0.63–2.0	0.12–0.14	4.5–6.0	Low	Moderate.	
45–70	40–65	40–50	20–30	0.2–0.63	0.10–0.12	4.5–6.0	Low	High.	
				<0.06					
60–70	40–50	25–35	0–10	2.0–6.3	0.12–0.14	5.1–6.5	Low	Moderate.	
85–95	75–85	60–70	30–40	0.06–0.2	0.06–0.08	5.1–6.0	Moderate	High.	
				<0.06	----------	5.6–6.0			
70–80	15–25	--------	NP	2.0–6.3	0.11–0.13	5.6–6.5	Low	Low.	
20–30	0–5	--------	NP	>20.0	0.03–0.05	6.1–7.3			
90–100	35–45	--------	NP	2.0–6.3	0.13–0.15	5.6–6.5	Low	Low.	
85–95	20–30	--------	NP	6.3–20.0	0.09–0.11	6.1–7.3	Low	Low.	
35–65	20–35	--------	NP	2.0–6.3	0.09–0.11	5.6–6.5	Low	Low.	
20–30	0–5	--------	NP	>20.0	0.03–0.05	6.1–7.3	Low	Low.	
90–95	60–70	20–30	0–10	0.63–2.0	0.16–0.18	5.6–7.3	Low	Low.	Seasonal high water table is at a depth of 4 to 5 feet in unit RmA.
40–70	35–45	20–30	0–10	2.0–6.3	0.12–0.14	5.6–7.3	Low	Low.	
85–95	80–90	70–80	45–55	0.06–0.2	0.15–0.17	5.6–7.3	High	High.	Material greater than 3 inches was on the surface of unit SdD2.
35–45	25–35	20–30	10–20	2.0–6.3	0.08–0.10	4.5–6.5	Low	Low.	Material greater than 3 inches was on the surface.
70–85	45–65	30–40	10–25	0.2–0.63	0.18–0.20	5.6–7.8	Moderate	High.	
70–80	50–60	20–30	10–20	0.63–2.0	0.16–0.18	5.6–7.8	Moderate	Low.	
70–80	45–55	30–40	10–20	0.2–0.63	0.14–0.16	6.1–7.8	Moderate	Moderate.	
50–60	35–45	30–40	15–25	0.2–0.63	0.14–0.16	6.1–7.8	Moderate	Moderate.	
70–80	45–55	20–30	5–10	0.63–2.0	0.16–0.18	5.1–6.5	Low	Low.	Bedrock is at a depth of 2½ to 4 feet in unit SmD3.
80–90	65–75	35–45	15–25	0.2–0.63	0.19–0.21	5.1–6.0	Moderate	Moderate.	

TABLE 5.—*Estmated soil properties*

Soil series and map symbols	Depth to—		Depth from surface of typical profile	Classification			Percentage greater than 3 inches (see also remarks column)	Percentage less than 3 inches passing sieve—	
	Bedrock or hardpan	Seasonal high water table		USDA texture	Unified	AASHO		No. 4 (4.7 mm.)	No. 10 (2.0 mm.)
	Feet	*Feet*	*Inches*						
Sites: SnC, SnD, SnE, SnF, SoD, SpE.	4->5	(1)	0–14	Loam	ML or CL	A-4 or A-6	1–3	85–100	85–100
			14–27	Clay loam	CL or ML	A-4 or A-6		90–100	85–100
			27–41	Clay	CL	A-7		90–100	85–100
			41–63	Clay loam	CL or ML	A-4 or A-6		90–100	85–100
Spreckels: SrA, SrB	1½–3	(1)	0–15	Fine sandy loam and loam.	SM or ML	A-4		100	95–100
			15–25	Clay	CH	A-7		90–100	85–95
			25–31	Hardpan					
			31–60	Consolidated tuffaceous alluvium.					
Stonyford: SsE, SsG	1½–2	(1)	0–24	Gravelly loam and gravelly clay loam.	SM or SC	A-6	3–10	70–85	60–80
			24	Weathered greenstone.					
Supan: StC, StD, StE, SuD, SuE.	2–3½	(1)	0–10	Loam and gravelly loam.	SC or SM	A-4 or A-6	3–10	75–95	70–90
			10–33	Gravelly clay loam	SC	A-6	0–25	75–85	70–80
			33	Tuff breccia.					
Tailings and Placer diggings: TaD. Too variable for valid estimates.									
Tehama: TbA, TbB, TbC.	>5	(1)	0–30	Loam	ML	A-4		100	95–100
			30–45	Silty clay loam	CL	A-6		100	95–100
			45–60	Very gravelly clay loam.	GC	A-2		30–60	20–50
Toomes: TcE, TeD	½–1½	(1)	0–11	Stony loam	ML or CL	A-4 or A-6	10–20	75–85	70–80
			11	Tuff breccia.					
Tujunga: TfA, TfB	>5	(1)	0–27	Loamy sand and sand	SM	A-2		90–100	90–100
			27–60	Very gravelly and very cobbly sand.	GP or GW	A-1	20–40	40–50	35–45
Tuscan: ThA, ThB	½–1½	(1)	0–16	Cobbly clay loam	SM or SC	A-4	15–25	75–85	70–80
			16–26	Hardpan					
			26–60	Gravelly and cobbly semiconsolidated alluvium.					
Vina:									
VeA, VfA	>5	(1)	0–63	Loam	ML or CL	A-4		100	100
VgB	>5	(1)	0–60	Gravelly loam	SM or SC	A-4		60–80	55–75
Wet alluvial land: Wa. Too variable for valid estimates.									
*Windy: WeD, WfE, WfG, WgE. For McCarthy part of these units, see McCarthy series.	3½–5	(1)	0–14	Stony sandy loam	SM	A-2	1–10	95 100	85–95
			14–48	Very gravelly sandy loam.	GM–GP or GM	A-1		45–55	40 50
			48	Volcanic rock.					

[1] Seasonal high water table is not present within depth of observation, which is generally is 5 feet unless limited by bedrock or hardpan.
[2] NP means nonplastic.
[3] For AnB, AnD, and ArD the surface layer is loam 5 to 10 inches thick.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—Continued		Atterberg values		Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel	Remarks
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index						
				Inches per hour	*Inches per inch of soil*	*pH value*			
70–80	55–65	25–35	5–15	0.63–2.0	0.16–0.18	5.6–6.5	Low	Low.	Material greater than 3 inches was on the surface of unit SoD.
80–90	65–75	30–40	5–15	0.63–2.0	0.19–0.21	4.5–6.0	Low	High.	
80–90	70–80	40–50	20–30	0.2–0.63	0.14–0.16	4.5–6.0	Moderate	High.	
80–90	65–75	30–40	5–15	0.63–2.0	0.19–0.21	4.5–5.0	Low	High.	
90–100	40–60	0–10	0–5	0.63–2.0	0.16–0.18	5.6–6.5	Moderate	Low.	
80–90	70–80	50–60	30–40	0.06–0.2	0.14–0.16	5.1–6.0	High	High.	
				<0.06		5.1–5.5			
50–60	40–50	30–40	10–20	0.63–2.0	0.14–0.16	5.6–7.3	Moderate	Moderate.	Material greater than 3 inches was on the surface.
50–70	35–50	25–35	5–15	0.63–2.0	0.16–0.18	6.1–7.8	Low	Low.	Material greater than 3 inches was on the surface of units SuD and SuE.
50–60	35–50	30–40	10–20	0.2–0.63	0.16–0.18	5.6–7.8	Moderate	Moderate.	
85–95	65–75	25–35	0–10	0.63–2.0	0.16–0.18	5.6–6.5	Low	Low.	Bedrock at a depth of 4 to more than 5 feet in units TbB and TbC.
85–95	85–95	30–40	20–30	0.06–0.2	0.19–0.21	6.1–7.3	Moderate	Moderate.	
15–40	10–25	30–40	15–25	0.2–0.63	0.10–0.12	6.6–7.3	Low	Moderate.	
60–70	55–65	25–35	5–15	0.63–2.0	0.10–0.12	5.6–6.5	Low	Low.	
60–70	10–20		NP	6.3–20.0	0.05–0.07	5.6–7.3	Low	Low.	
30–40	0–5		NP	>20.0	0.03–0.05	5.6–7.3	Low	Low.	
55–65	40–50	20–30	0–10	0.2–0.63	0.15–0.17	5.1–7.3	Moderate	Moderate.	
				<0.06					
90–100	60–70	20–30	0–10	0.63–2.0	0.16–0.18	5.6–7.3	Moderate	Low.	Seasonal high water table at a depth of 3 to 5 feet in unit VfA.
50–70	35–50	20–30	0–10	0.63–2.0	0.12–0.14	5.6–7.3	Low	Low.	
50–60	25–35		NP	2.0–6.3	0.10–0.12	4.5–6.5	Low	Moderate.	Material greater than 3 inches was on the surface.
30–40	5–15		NP	6.3–20.0	0.06–0.08	4.5–6.0	Low	Moderate.	

[4] In PoA and PoB the soil is underlain at a depth of 24 to 36 inches by weakly consolidated, very slowly permeable sediment.
[5] In RhA the 0- to 40-inch layer is fine sandy loam.

TABLE 6.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil, which may in the first column

Soil series and map symbols	Suitability as source of — Topsoil	Sand and gravel [1]	Road fill	Hydrologic soil group	Soil features affecting— Road location
Aiken: AaB, AaC, AaD, AbB, AbC, AbD, AcE.	Fair: clay loam over clay.	Unsuitable: more than 50 percent fines.	Poor: dominantly A–1 material.	B	Moderate shrink-swell potential; 0 to 35 percent of surface covered by stones; 0 to 50 percent slopes.
Anderson: Ad	Poor: gravelly sandy loam and very gravelly sandy loam.	Good to fair: 5 to 25 percent fines.	Good	B	0 to 20 percent cobblestones or stones.
Ae	Poor: gravelly sandy loam.	Fair: 15 to 25 percent fines.	Good	C	1½ to 3 feet to consolidated alluvium.
Anita: AhB, AkB	Poor: gravelly clay.	Unsuitable: more than 50 percent fines.	Poor: A–7 material.	D	High shrink-swell potential; 3 to 10 percent of surface of AkB covered by cobblestones; decomposed tuff is at depth of 1 to 3½ feet.
Auberry: AlB, AlD, AlF.	Fair to poor: loam over clay loam; bedrock is at depth of 1½ to 4 feet.	Unsuitable: more than 50 percent fines.	Poor dominantly A–6 material.	B where bedrock is at depth of more than 40 inches; C where bedrock is at depth of 20 to 40 inches.	Decomposed granite is at depth of 1½ to 4 feet; 0 to 70 percent slopes.
Auburn: AnB, AnD, ArD, AsD2, AtE2, AuF2.	Poor: loam and gravelly clay loam; bedrock is at depth of 1 to 2½ feet.	Unsuitable: more than 50 percent fines.	Fair: A–4 material.	D where bedrock is at depth of 12 to 20 inches; C where bedrock is at depth of 20 to 32 inches.	Metabasic rock is at depth of 1 to 2½ feet; 0 to 70 percent slopes; unit AtE2 is very stony; unit AuF2 is very rocky.

See footnotes at end of table.

properties of the soils—Continued

have different properties and interpretations. For this reason the reader should follow carefully the instructions for referring to other series of this table]

Soil features affecting—Continued					Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation		Septic tank filter fields
Embankments	Reservoir areas				
Moderate to low strength; medium to high compressibility; medium susceptibility to piping; low to medium permeability after compaction; poor compaction characteristics.	Moderately slow permeability; 0 to 50 percent slopes.	Moderately slow permeability.	High water-holding capacity; moderately slow water intake rate; 0 to 50 percent slopes.		Severe: moderately slow permeability; 0 to 50 percent slopes.
Medium to high strength; low to medium compressibility; medium to high susceptibility to piping; medium permeability after compaction; fair to good compaction characteristics.	Rapid permeability; 0 to 3 percent slopes.	Rapid permeability	Low water-holding capacity; moderately rapid water intake rate.		Slight.[2]
Medium strength; low to medium compressibility; medium to low susceptibility to piping; medium to low permeability after compaction; fair to good compaction characteristics.	Slow permeability; 1½ to 3 feet to consolidated alluvium; 0 to 3 percent slopes.	Slow permeability; 1½ to 3 feet to consolidated alluvium.	Low water-holding capacity; moderately rapid water intake rate; 1½ to 3 feet to consolidated alluvium.		Severe: slow permeability.
Low strength; high compressibility; low susceptibility to piping; low permeability after compaction; fair to poor compaction characteristics.	Slow permeability; decomposed tuff is at depth of 1 to 3½ feet; 0 to 8 percent slopes.	Slow permeability; decomposed tuff is at depth of 1 to 3½ feet.	Low to medium water-holding capacity; slow water intake rate; decomposed tuff is at depth of 1 to 3½ feet.		Severe: slow permeability; cemented, decomposed tuff is at depth of 1 to 3½ feet.
Medium to low strength; medium compressibility; medium to high susceptibility to piping; medium to low permeability after compaction; fair to good compaction characteristics.	Moderately slow permeability; decomposed granite is at depth of 1½ to 4 feet; 0 to 70 percent slopes.	Moderately slow permeability; decomposed granite is at depth of 1½ to 4 feet.	Low to medium water-holding capacity; moderate water intake rate; bedrock is at depth of 1½ to 4 feet; 0 to 70 percent slopes.		Severe: moderately slow permeability; bedrock is at depth of 1½ to 4 feet; 0 to 70 percent slopes.
Medium to low strength; medium compressibilsity; medium to high pusceptibility to biping; low permeaility after compaction: fair to good compaction characteristics.	Moderate permeability; metabasic rock is at depth of 1 to 2½ feet; 0 to 70 percent slopes.	Moderate permeability; metabasic rock is at depth of 1 to 2½ feet.	Low to medium water-holding capacity; moderate water intake rate; metabasic rock is at depth of 1 to 2½ feet; 0 to 70 percent slopes.		Severe: bedrock is at depth of 1 to 2½ feet; 0 to 70 percent slopes.

TABLE 6. —*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel [1]	Road fill		Road location
Behemotosh: BeD, BeE2, BhF2.	Poor: gravelly loam over very cobbly clay loam; bedrock is at depth of 1½ to 4½ feet.	Unsuitable: more than 50 percent fines; soils are very cobbly or very stony.	Fair to poor: A–4 or A–6 material.	B where bedrock is at depth of 40 to 52 inches; C where bedrock is at depth of 18 to 40 inches.	30 to 50 percent stones or cobblestones throughout; rhyolite is at depth of 1½ to 4½ feet; 8 to 70 percent slopes.
Boomer: BkC, BkD, BkE, BlF, BoE3, BoF3.	Fair to poor: gravelly clay loam and clay loam; units BlF, BoE3, and BoF3 have a very stony surface layer; bedrock is at depth of 1½ to more than 5 feet.	Unsuitable: more than 50 percent fines; units BlF, BoE3, and BoF3 have a very stony surface layer.	Poor: A–6 material.	B for units BkC, BkD, BkE, and BlF; C for units BoE3 and BoF3.	3 to 15 percent of surface covered by stones in units BlF, BoE3, and BoF3; bedrock is at depth of 1½ to more than 5 feet; 0 to 70 percent slopes.
Chaix: CaE3, CaF3, CbD2, CbE, CbF.	Fair: sandy loam; bedrock is at depth of 1½ to 3½ feet.	Fair to poor for sand; 25 to 35 percent fines. Unsuitable for gravel; less than 25 percent gravel.[3]	Good	C	Granite is at depth of 1½ to 3½ feet; 5 to 70 percent slopes.
Churn: CcA, CcB, CdA	Fair: loam over clay loam.	Unsuitable: more than 50 percent fines.	Fair to poor: A–4 or A–6 material.	B	Unit CdA has water table at depth of 4 to more than 5 feet; all other features are favorable.
CeA, CeB, CfA, CfB.	Poor: gravelly loam over gravelly clay loam; consolidated alluvium is at depth of 3 to 5 feet in units CfA and CfB.	Poor to unsuitable for sand; 35 to 60 percent fines. Poor for gravel; 30 to 40 percent gravel.	Fair to poor: A–4 or A–6 material.	B	Consolidated alluvium is at depth of 3 to 5 feet in units CfA and CfB.
Clough: CgB	Poor: gravelly loam over very gravelly clay; hardpan is at depth of 1½ to 2½ feet.	Poor to fair for sand; 20 to 45 percent fines. Poor to fair for gravel; 35 to 70 percent gravel.	Good to fair: A–2 or A–4 material.	D	Hardpan is at depth of 1½ to 2½ feet.
Cobbly alluvial land: Ch, Ck. Too variable for valid interpretations.					

See footnotes at end of table.

properties of the soils—Continued

Soil features affecting—Continued				Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation	Septic tank filter fields
Embankments	Reservoir areas			
Medium to low strength; medium compressibility; low to medium susceptibility to piping; low permeability after compaction; fair to good compaction characteristics.	Moderately slow permeability; rhyolite is at depth of 1½ to 4½ feet; 8 to 70 percent slopes.	Moderately slow permeability; rhyolite is at depth of 1½ to 4½ feet.	Low to medium water-holding capacity; moderate water intake rate; rhyolite is at depth of 1½ to 4½ feet; 8 to 70 percent slopes.	Severe: moderately slow permeability; rhyolite is at depth of 1½ to 4½ feet; 8 to 70 percent slopes.
Medium to low strength; medium compressibility; low to medium susceptibility to piping; low permeability after compaction; fair to good compaction characteristics.	Moderately slow permeability; bedrock is at depth of 1½ to more than 5 feet; 0 to 70 percent slopes.	Moderately slow permeability: bedrock is at depth of 1½ to more than 5 feet.	High water-holding capacity; moderately slow water intake rate; bedrock is at depth of 1½ to more than 5 feet; 0 to 70 percent slopes.	Severe: moderately slow permeability; bedrock is at depth of 1½ to more than 5 feet; 0 to 70 percent slopes.
Medium strength; low to medium compressibility; medium to high susceptibility to piping; medium to low permeability after compaction; fair to good compaction characteristics.	Moderately rapid permeability; granite is at depth of 1½ to 3½ feet; 5 to 70 percent slopes.	Moderately rapid permeability; granite is at depth of 1½ to 3½ feet.	Low water-holding capacity; rapid water intake rate; granite is at depth of 1½ to 3½ feet; 5 to 70 percent slopes.	Severe: bedrock is at depth of 1½ to 3½ feet; 5 to 70 percent slopes.
Medium to low strength; medium compressibility; low to medium susceptibility to piping; low permeability after compaction; fair to good compaction characteristics.	Moderately slow permeability; 0 to 8 percent slopes.	Moderately slow permeability; unit CdA has water table at depth of 4 to more than 5 feet.	High water-holding capacity; moderate water intake rate; 0 to 8 percent slopes.	Severe: moderately slow permeability.
Medium to low strength; medium compressibility; low to medium susceptibility to piping; low permeability after compaction; fair to good compaction characteristics.	Moderately slow to slow permeability; consolidated alluvium is at depth of 3 to 5 feet in units CfA and CfB; 0 to 8 percent slopes.	Moderately slow to slow permeability; consolidated alluvium is at depth of 3 to 5 feet in units CfA and CfB.	Medium to high water-holding capacity; moderate water intake rate; 0 to 8 percent slopes.	Severe: moderately slow to slow permeability.
Medium strength; low to medium compressibility; medium to low susceptibility to piping; medium to low permeability after compaction; fair to good compaction characteristics.	Very slow permeability; hardpan is at depth of 1½ to 2½ feet; 3 to 8 percent slopes.	Very slow permeability; hardpan is at a depth of 1½ to 2½ feet.	Low water-holding capacity; moderate water intake rate; hardpan is at depth of 1½ to 2½ feet.	Severe: very slow permeability; hardpan is at depth of 1½ to 2½ feet.

TABLE 6. *Interpretations of engineering*

Soil series and map symbols	Suitability as source of —			Hydrologic soil group	Soil features affecting —
	Topsoil	Sand and gravel [1]	Road fill		Road location
*Cobasset: ClD, CmD, CmE, CnF, CoE, CpD, CrD, CrE, CrG. For Aiken part of unit CpD, see Aiken series; for McCarthy part of units CrD, CrE, and CrG, see McCarthy series.	Fair to poor: loam over gravelly clay loam; bedrock is at depth of 2 to more than 5 feet.	Unsuitable: more than 50 percent fines; 0 to 50 percent cobblestones or stones.	Poor to fair: A-4 and A-6 material.	B for all units except CoE, C in unit CoE.	0 to 50 percent cobblestones or stones; bedrock is at depth of 2 to more than 5 feet; 0 to 75 percent slopes.
Colluvial land: CsF. Too variable for valid interpretations.					
Cone: CtC, CtD, CuD, CvE, CwF.	Fair to poor: gravelly loam; cinders at depth of 2 to more than 5 feet.	Poor for sand; 25 to 35 percent fines. Poor for gravel; 35 to 45 percent gravel; 0 to 15 percent stones on surface.	Good	A	0 to 15 percent of surface covered by stones; cinders at depth of 2 to more than 5 feet; 3 to 60 percent slopes.
Corbett: CxE, CxF3, CxG, CyG.	Poor: loamy coarse sand; bedrock is at depth of 1½ to 3½ feet.	Fair for sand; 15 to 30 percent fines. Unsuitable for gravel; 0 to 5 percent gravel.	Good	C	Granite is at depth of 1½ to 3½ feet; 15 to 80 percent slopes.
Diamond Springs: DfD2, DgE2, DgE3.	Fair to poor: sandy loam over sandy clay loam; bedrock is at depth of 1½ to 5 feet.	Poor for sand; 30 to 50 percent fines. Unsuitable for gravel; 0 to 10 percent gravel.	Good to poor: A-2, A-4, or A-6 material.	B where bedrock is at depth of 40 to 60 inches; C where bedrock is at depth of 20 to 40 inches.	3 to 15 percent of surface covered by stones; metadacite is at depth of 1½ to 5 feet; 8 to 50 percent slopes.
Forward: FaD, FaE, FdD.	Fair to poor: sandy loam over loamy sand; bedrock is at depth of 1½ to 4 feet.	Fair to poor for sand; 20 to 30 percent fines. Unsuitable for gravel; 0 to 10 percent gravel.	Good	C for all units except FdD, B in unit FdD.	Decomposed tuff is at depth of 1½ to 4 feet; 0 to 50 percent slopes.

See footnote at end of table.

properties of the soils—Continued

Soil features affecting—Continued				Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation	Septic tank filter fields
Embankments	Reservoir areas			
Medium to low strength; medium compressibility; low to medium susceptibility to piping; low permeability after compaction; fair to good compaction characteristics.	Moderate permeability; bedrock is at depth of 2 to more than 5 feet; 0 to 75 percent slopes.	Moderate permeability; bedrock is at depth of 2 to more than 5 feet.	Medium to high water-holding capacity; moderate water intake rate; bedrock is at depth of 2 to more than 5 feet; 0 to 75 percent slopes.	Moderate for 0 to 15 percent slopes; moderate permeability; severe for 15 to 75 percent slopes.
Medium strength; low to medium compressibility; medium to high susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Rapid permeability; cinders at depth of 2 to more than 5 feet; 3 to 60 percent slopes.	Rapid permeability; cinders at depth of 2 to more than 5 feet.	Medium to high water-holding capacity; rapid water intake rate; cinders at depth of 2 to more than 5 feet; 3 to 60 percent slopes.	Slight for 3 to 8 percent slopes; moderate for 8 to 15 percent slopes; severe for 15 to 60 percent slopes. [2]
Medium strength; low to medium compressibility; medium to high susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Rapid permeability; granite is at depth of 1½ to 3½ feet; 15 to 80 percent slopes.	Rapid permeability; granite is at depth of 1½ to 3½ feet.	Low water-holding capacity; rapid water intake rate; granite is at depth of 1½ to 3½ feet; 15 to 80 percent slopes.	Severe: bedrock is at depth of 1½ to 3½ feet; 15 to 80 percent slopes.
Medium strength; low to medium compressibility; medium susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderate permeability; metadacite is at depth of 1½ to 5 feet; 8 to 50 percent slopes.	Moderate permeability; metadacite is at depth of 1½ to 5 feet.	Medium to high water-holding capacity; moderately rapid water intake rate; metadacite is at depth of 1½ to 5 feet; 8 to 50 percent slopes.	Severe: bedrock is at depth of 1½ to 5 feet; 8 to 50 percent slopes.
Medium strength; low to medium compressibility; medium to high susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderately rapid permeability; decomposed tuff is at depth of 1½ to 4 feet; 0 to 50 percent slopes.	Moderately rapid permeability; decomposed tuff is at depth of 1½ to 4 feet.	Low to medium water-holding capacity; rapid water intake rate; decomposed tuff is at depth of 1½ to 4 feet; 0 to 50 percent slopes.	Severe: bedrock is at depth of 1½ to 4 feet; 0 to 50 percent slopes.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Suitability as source of— Sand and gravel [1]	Suitability as source of— Road fill	Hydrologic soil group	Soil features affecting— Road location
Gaviota: GaC, GaD, GbD, GbE2.	Poor: sandy loam; bedrock is at depth of ½ to 1½ feet.	Unsuitable: bedrock is at depth of ½ to 1½ feet.	Good	D	Sandstone is at depth of ½ to 1½ feet; 0 to 50 percent slopes.
Goulding: GdD, GeE2, GeF2.	Poor: gravelly loam; bedrock is at depth of 1 to 2 feet.	Unsuitable: bedrock is at depth of 1 to 2 feet.	Fair: A-4 material.	D	0 to 15 percent of surface covered by stones; greenstone is at depth of 1 to 2 feet; 10 to 70 percent slopes.
Gravel pits: Gp. Too variable for valid interpretations.					
Guenoc: GsD, GuD, GuE.	Poor: very stony loam over very cobbly clay loam; bedrock is at depth of 1½ to 3½ feet.	Poor to unsuitable for sand; 35 to 75 percent fines. Poor to unsuitable for gravel; 10 to 40 percent gravel. 3 to 50 percent stones throughout.	Fair to poor: A-4 and A-6 material.	C	3 to 50 percent stones throughout; andesite is at depth of 1½ to 3½ feet; 0 to 50 percent slopes.
Henneke: HaF	Poor: loam over very stony clay loam; bedrock is at depth of 1 to 2 feet.	Unsuitable for sand and gravel; poor quality material; bedrock is at depth of 1 to 2 feet.	Good to fair: A-2 or A-4 material.	D	20 to 45 percent stones in subsoil; serpentine is at depth of 1 to 2 feet; 15 to 60 percent slopes.
Hillgate: Hb	Poor: loam over clay.	Unsuitable: more than 50 percent fines.	Fair to poor: A-4, A-6, or A-7 material.	D	High shrink-swell potential; 0 to 2 percent slopes.
Holland: HcE, HcF	Fair: sandy loam and loam over clay loam; bedrock is at depth of 3½ to more than 5 feet.	Unsuitable: mostly more than 50 percent fines.	Fair to poor: A-4 or A-6 material.	B	Quartz diorite is at depth of 3½ to more than 5 feet; 15 to 70 percent slopes.

See footnotes at end of table.

properties of the soils Continued

Soil features affecting—Continued				Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation	Septic tank filter fields
Embankments	Reservoir areas			
Medium strength; low to medium compressibility; medium to high susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderately rapid permeability; sandstone is at depth of ½ to 1½ feet; 0 to 50 percent slopes.	Moderately rapid permeability; sandstone is at depth of ½ to 1½ feet.	Low water-holding capacity; rapid water intake rate; sandstone is at depth of ½ to 1½ feet; 0 to 50 percent slopes.	Severe: bedrock is at depth of ½ to 1½ feet; 0 to 50 percent slopes.
Medium strength; low to medium compressibility; medium to high susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderate permeability; greenstone is at depth of 1 to 2 feet; 10 to 70 percent slopes.	Moderate permeability; greenstone is at depth of 1 to 2 feet.	Low water-holding capacity; moderate water intake rate; greenstone is at depth of 1 to 2 feet; 10 to 70 percent slopes.	Severe: bedrock is at depth of 1 to 2 feet; 10 to 70 percent slopes.
Medium to low strength; medium compressibility; low to medium susceptibility to piping; low permeability after compaction; fair to good compaction characteristics.	Moderately slow permeability; andesite is at depth of 1½ to 3½ feet; 0 to 50 percent slopes.	Moderately slow permeability; andesite is at depth of 1½ to 3½ feet.	Medium water-holding capacity; moderate water intake rate; andesite is at depth of 1½ to 3½ feet; 0 to 50 percent slopes.	Severe: moderately slow permeability; bedrock is at depth of 1½ to 3½ feet; 0 to 50 percent slopes.
Medium strength; low to medium compressibility; low to medium susceptibility to piping; low to medium permeability after compaction; good to fair compaction characteristics.	Moderately slow permeability; serpentine is at depth of 1 to 2 feet; 15 to 60 percent slopes.	Moderately slow permeability; serpentine is at depth of 1 to 2 feet.	Low water-holding capacity; moderate water intake rate; serpentine is at depth of 1 to 2 feet; 15 to 60 percent slopes.	Severe: moderately slow permeability; bedrock is at depth of 1 to 2 feet; 15 to 60 percent slopes.
Medium to low strength; medium compressibility; low to medium susceptibility to piping; low permeability after compaction; fair to good compaction characteristics.	Very slow permeability; 0 to 2 percent slopes.	Very slow permeability---	Low water-holding capacity; moderate water intake rate; very slowly permeable clay is at depth of 8 to 24 inches.	Severe: very slow permeability.
Medium to low strength; medium compressibility; medium susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderately slow permeability; quartz diorite is at depth of 3½ to more than 5 feet; 15 to 70 percent slopes.	Moderately slow permeability; quartz diorite is at depth of 3½ to more than 5 feet.	High water-holding capacity; moderate water intake rate; quartz diorite is at depth of 3½ to more than 5 feet; 15 to 70 percent slopes.	Severe: moderately slow permeability; bedrock is at depth of 3½ to more than 5 feet.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of —			Hydrologic soil group	Soil features affecting —
	Topsoil	Sand and gravel [1]	Road fill		Road location
Honcut: Hd, He	Good	Unsuitable: more than 50 percent fines.	Fair: A-4 material	B	Most features are favorable; 0 to 2 percent slopes.
Hf	Fair: gravelly loam over very gravelly loam.	Fair to poor for sand; 20 to 50 percent fines. Fair to poor for gravel; 20 to 60 percent gravel.	Good to fair: A-1 to A-4 material.	B	Very gravelly below depth of 40 inches; 0 to 2 percent slopes.
Honn: HgA, HgB, HhA.	Fair: gravelly sandy loam over gravelly and very gravelly sandy clay loam.	Fair to poor for sand; 15 to 35 percent fines. Fair to poor for gravel; 25 to 65 percent gravel.	Good	B	Weakly consolidated alluvium below depth of 3½ to 5 feet; 0 to 8 percent slopes.
Igo: IaB	Poor: gravelly loam; hardpan is at depth of 3 to 12 inches.	Unsuitable: hardpan is at depth of 3 to 12 inches.	Fair to poor: A-4 or A-6 material.	D	Hardpan is at depth of 3 to 12 inches; 0 to 8 percent slopes.
*Inks: IbD, IdD, IdE, IeD, IeE. For Pentz part of units IeD and IeE, see Pentz series.	Poor: loam and gravelly loam over very gravelly clay loam; bedrock is at depth of 1 to 1½ feet.	Unsuitable: bedrock is at depth of 1 to 1½ feet.	Poor to good: A-2, A-4, or A-6 material.	D	0 to 15 percent of surface covered by stones; decomposed tuff is at depth of 1 to 1½ feet; 3 to 50 percent slopes.
Jiggs. Jiggs soils are mapped only in complexes or undifferentiated groups with Lyonsville soils.	Poor: gravelly sandy loam; bedrock is at depth of 1½ to 3½ feet.	Good to fair for sand; 25 to 35 percent fines. Poor for gravel; 25 to 40 percent gravel.	Good	C	Dacite is at depth of 1½ to 3½ feet; 10 to 70 percent slopes.
*Josephine: JbD, JbE, JbF, JdD, JdE, JsF. For Sheetiron part of unit JsF, see Sheetiron series.	Poor: gravelly clay loam over very stony clay loam; bedrock is at depth of 2 to more than 5 feet.	Poor for sand; 35 to 50 percent fines. Fair for gravel; 30 to 40 percent gravel. 10 to 40 percent stones in subsoil.	Poor: A-6 material.	B in all units except JdD and JdE; C in units JdD and JdE.	10 to 40 percent stones in subsoil; bedrock is at depth of 2 to more than 5 feet; 10 to 70 percent slopes.

See footnotes at end of table.

properties of the soils—Continued

Soil features affecting—Continued				Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation	Septic tank filter fields
Embankments	Reservoir areas			
Medium to low strength; medium compressibility; high susceptibility to piping; medium to low permeability after compaction; good to poor compaction characteristics.	Moderate permeability; 0 to 2 percent slopes.	Moderate permeability	High water-holding capacity; moderate water intake rate.	Moderate: moderate permeability.
Medium strength; medium compressibility; medium susceptibility to piping; medium permeability after compaction; fair compaction characteristics.	Rapid permeability below depth of 40 inches; 0 to 2 percent slopes.	Rapid permeability below depth of 40 inches.	Medium water-holding capacity; moderate water intake rate; very gravelly loam is at depth of 40 to 60 inches.	Slight.
Medium strength; low to medium compressibility; low to medium susceptibility to piping; low permeability after compaction; good to fair compaction characteristics.	Moderately slow permeability; weakly consolidated alluvium is at depth of 3½ to 5 feet; 0 to 8 percent slopes.	Moderately slow permeability; weakly consolidated alluvium is at depth of 3½ to 5 feet.	Medium to high water-holding capacity; rapid water intake rate; weakly consolidated alluvium is at depth of 3½ to 5 feet; 0 to 8 percent slopes.	Severe: moderately slow permeability.
Medium strength; low to medium compressibility; medium susceptibility to piping; low to medium permeability after compaction; good to fair compaction characteristics.	Very slow permeability; hardpan is at depth of 3 to 12 inches.	Very slow permeability; hardpan is at depth of 3 to 12 inches.	Low water-holding capacity; moderate water intake rate; hardpan is at depth of 3 to 12 inches; 0 to 8 percent slopes.	Severe: very slow permeability; hardpan is at depth of 3 to 12 inches.
Medium strength; low to medium compressibility; low to medium susceptibility to piping; low permeability after compaction; good to fair compaction characteristics.	Moderate permeability; decomposed tuff is at depth of 1 to 1½ feet; 3 to 50 percent slopes.	Moderate permeability; decomposed tuff is at depth of 1 to 1½ feet.	Low water-holding capacity; moderate water intake rate; decomposed tuff is at depth of 1 to 1½ feet; 3 to 50 percent slopes.	Severe: decomposed tuff is at depth of 1 to 1½ feet; 3 to 50 percent slopes.
Medium strength; low to medium compressibility; medium to high susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderately rapid permeability; dacite is at depth of 1½ to 3½ feet; 10 to 70 percent slopes.	Moderately rapid permeability; dacite is at depth of 1½ to 3½ feet.	Low water-holding capacity; rapid water intake rate; dacite is at depth of 1½ to 3½ feet; 10 to 70 percent slopes.	Severe: bedrock is at depth of 1½ to 3½ feet; 10 to 70 percent slopes.
Medium strength; low to medium compressibility; low to medium susceptibility to piping; low permeability after compaction; good compaction characteristics.	Moderate permeability; bedrock is at depth of 2 to more than 5 feet; 10 to 70 percent slopes.	Moderate permeability; bedrock is at depth of 2 to more than 5 feet.	Medium to high water-holding capacity; moderate water intake rate; bedrock is at depth of 2 to more than 5 feet; 10 to 70 percent slopes.	Severe: bedrock is at depth of 2 to more than 5 feet; 10 to 70 percent slopes.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Sand and gravel [1]	Road fill	Hydrologic soil group	Soil features affecting— Road location
Kanaka: KbC, KcD, KcE, KcF2.	Fair: sandy loam; bedrock is at depth of 1½ to 4 feet.	Poor for sand; 30 to 40 percent fines. Unsuitable for gravel; 5 to 15 percent gravel.	Good to fair: A–2 or A–4 material.	C	Granodiorite is at depth of 1½ to 4 feet; 3 to 70 percent slopes.
Keefers: KdA, KdB, KeB.	Poor: gravelly clay loam over very gravelly clay.	Fair to unsuitable for sand; 40 to 85 percent fines. Fair to unsuitable for gravel; 10 to 80 percent gravel.	Good to poor: A–2 or A–6 material.	C	Very gravelly clay subsoil; weakly cemented below depth of 2 to 3½ feet; 0 to 8 per-percent slopes.
Kidd: KgF2	Poor: gravelly loam and very gravelly loam; bedrock is at depth of ½ to 1½ feet.	Unsuitable: bedrock is at depth of ½ to 1½ feet.	Good: A–2 material.	D	Rhyolite is at depth of ½ to 1½ feet; 10 to 60 percent slopes.
*Kilaro: KnC, KhD, KhE, KlD, KlE, KsD. For Sites part of unit KsD, see Sites series.	Poor: sandy clay loam over clay; bedrock is at depth of 2 to 4 feet.	Unsuitable: mostly more than 50 percent fines.	Fair to poor: A–4, A–6, or A–7 material.	C	High shrink-swell potential; 0 to 15 percent of surface covered by stones; sandstone is at depth of 2 to 4 feet; 2 to 50 percent slopes.
Landslides: LaE. Too variable for valid interpretations.					
Lodo: LbE, LbF3	Poor: shaly loam; bedrock is at depth of ½ to 1 foot.	Unsuitable: poor quality material; bedrock is at depth of ½ to 1 foot.	Fair to poor: A–4 or A–6 material.	D	Shale is at depth of ½ to 1 foot; 10 to 70 percent slopes.
Los Robles: LcA, LcB, LdA, LeB, LfA.	Good	Unsuitable: mostly more than 50 percent fines.	Poor: A–6 material.	B in all units except LeB; C in unit LeB.	Lava is at depth of 2 to 4 feet in unit LeB; unit LdA is seeped.

See footnotes at end of table.

properties of the soils Continued

Soil features affecting—Continued					Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation		Septic tank filter fields
Embankments	Reservoir areas				
Medium strength; low to medium compressibility; medium to high susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderately rapid permeability; granodiorite is at depth of 1½ to 4 feet; 3 to 70 percent slopes.	Moderately rapid permeability; granodiorite is at depth of 1½ to 4 feet.	Low to medium water-holding capacity; moderately rapid water intake rate; granodiorite is at depth of 1½ to 4 feet; 3 to 70 percent slopes.		Severe: bedrock is at depth of 1½ to 4 feet; 3 to 70 percent slopes.
Medium strength; low to medium compressibility; low to medium susceptibility to piping; low permeability after compaction; good to fair compaction characteristics.	Slow permeability; weakly cemented at depth of 2 to 3½ feet.	Slow permeability; weakly cemented at depth of 2 to 3½ feet.	Medium water-holding capacity; moderate water intake rate; weakly cemented at depth of 2 to 3½ feet; 0 to 8 percent slopes.		Severe: slow permeability.
High to medium strength; low compressibility; low to medium susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderately rapid permeability; rhyolite is at depth of ½ to 1½ feet; 10 to 60 percent slopes.	Moderately rapid permeability; rhyolite is at depth of ½ to 1½ feet.	Low water-holding capacity; moderately rapid water intake rate; rhyolite is at depth of ½ to 1½ feet; 10 to 60 percent slopes.		Severe: rhyolite is at depth of ½ to 1½ feet; 10 to 60 percent slopes.
Low to medium strength; medium to high compressibility; low to medium susceptibility to piping; low permeability after compaction; fair compaction characteristics.	Slow permeability; sandstone is at depth of 2 to 4 feet feet; 2 to 50 percent slopes.	Slow permeability; sandstone is at depth of 2 to 4 feet.	Medium to high water-holding capacity; moderate water intake rate; sandstone is at depth of 2 to 4 feet; 2 to 50 percent slopes.		Severe: slow permeability; bedrock is at depth of 2 to 4 feet; 2 to 50 percent slopes.
Medium strength; low to medium compressibility; medium susceptibility to piping; low to medium permeability after compaction; good to fair compaction characteristics.	Moderate permeability; shale is at depth of ½ to 1 foot; 10 to 70 percent slopes.	Moderate permeability; shale is at depth of ½ to 1 foot.	Very low water-holding capacity; moderately rapid water intake rate; shale is at depth of ½ to 1 foot; 10 to 70 percent slopes.		Severe: shale is at depth of ½ to 1 foot; 10 to 70 percent slopes.
Low to medium strength; low to medium compressibility; low to medium susceptibility to piping; low permeability after compaction; fair to good compaction characteristics.	Moderately slow permeability; lava is at depth of 2 to 4 feet in unit LeB.	Moderately slow permeability; lava is at depth of 2 to 4 feet in unit LeB; unit LdA is seeped.	Medium to high water-holding capacity; moderate water intake rate; lava is at depth of 2 to 4 feet in unit LeB; unit LdA is seeped.		Severe: moderately slow permeability.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Sand and gravel [1]	Road fill	Hydrologic soil group	Soil features affecting— Road location
*Lyonsville: LgE, LhE, LkF. For Jiggs part of these units, see Jiggs series.	Fair: gravelly sandy clay loam; bedrock is at depth of 2 to 5 feet.	Fair to poor for sand; 25 to 35 percent fines. Poor for gravel; 25 to 35 percent gravel.	Good	B where bedrock is at depth of 40 to 60 inches; C where bedrock is at depth of 20 to 40 inches.	3 to 10 percent of surface is covered by stones; dacite is at depth of 2 to 5 feet; 10 to 70 percent slopes.
Marpa: MaE, MaG	Poor: gravelly loam over very gravelly clay loam; bedrock is at depth of 1½ to 3½ feet.	Good to unsuitable for sand; 10 to 60 percent fines. Good to poor for gravel; 25 to 80 percent gravel.	Good to poor: A–2 or A–6 material.	C	Shale is at depth of 1½ to 3½ feet; 30 to 75 percent slopes.
Maymen: MbG2	Poor: gravelly loam; bedrock is at depth of ½ to 1½ feet.	Unsuitable: bedrock is at depth of ½ to 1½ feet.	Good	D	3 to 15 percent of surface covered by stones; shale is at depth of ½ to 1½ feet; 30 to 80 percent slopes.
McCarthy. McCarthy soils are mapped only in complexes or undifferentiated groups with Cohasset or Windy soils.	Poor: gravelly sandy loam over very cobbly sandy loam; bedrock is at depth of 3½ to 5 feet.	Fair for sand; 15 to 25 percent fines. Fair to poor for gravel; 25 to 60 percent gravel. 1 to 50 percent cobblestones and stones throughout.	Good	B	1 to 50 percent cobblestones and stones throughout; basalt is at depth of 3½ to 5 feet; 0 to 75 percent slopes.
Millsap: McD, McE, McG, MdE.	Poor: loam over silty clay; bedrock is at depth of 1½ to 3½ feet.	Unsuitable: more than 50 percent fines.	Poor: A–6 or A–7 material.	C	High shrink-swell potential; bedrock is at depth of 1½ to 3½ feet; 5 to 75 percent slopes.
Millsholm: MeD, MeD2, MeE, MeG, MfE2, MfF2.	Poor: gravelly loam; bedrock is at depth of ½ to 1½ feet.	Unsuitable: bedrock is at depth of ½ to 1½ feet.	Good	D	Bedrock is at depth of ½ to 1½ feet; 3 to 75 percent slopes.

See footnotes at end of table.

properties of the soils —Continued

Soil features affecting—Continued				Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation	Septic tank filter fields
Embankments	Reservoir areas			
Medium strength; low to medium compressibility; medium susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderate permeability; dacite is at depth of 2 to 5 feet; 10 to 70 percent slopes.	Moderate permeability; dacite is at depth of 2 to 5 feet.	Medium water-holding capacity; moderate water intake rate; dacite is at depth of 2 to 5 feet; 10 to 70 percent slopes.	Severe: bedrock is at depth of 2 to 5 feet; 10 to 70 percent slopes.
Medium strength; low to medium compressibility; low to medium susceptibility to piping; low permeability after compaction; good to fair compaction characteristics.	Moderate permeability; shale is at depth of 1½ to 3½ feet; 30 to 75 percent slopes.	Moderate permeability; shale is at depth of 1½ to 3½ feet.	Medium water-holding capacity; moderate water intake rate; shale is at depth of 1½ to 3½ feet; 30 to 75 percent slopes.	Severe: bedrock is at depth of 1½ to 3½ feet; 30 to 75 percent slopes.
Medium strength; low to medium compressibility; medium susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderate permeability; shale is at depth of ½ to 1½ feet; 30 to 80 percent slopes.	Moderate permeability; shale is at depth of ½ to 1½ feet.	Low water-holding capacity; moderately rapid water intake rate; shale is at depth of ½ to 1½ feet; 30 to 80 percent slopes.	Severe: shale is at depth of ½ to 1½ feet; 30 to 80 percent slopes.
Medium to high strength; low compressibility; medium to low susceptibility to piping; medium to low permeability after compaction; fair to good compaction characteristics.	Moderately rapid permeability; basalt is at depth of 3½ to 5 feet; 0 to 75 percent slopes.	Moderately rapid permeability; basalt is at depth of 3½ to 5 feet.	Medium water-holding capacity; moderately rapid water intake rate; basalt is at depth of 3½ to 5 feet; 0 to 75 percent slopes.	Severe: bedrock is at depth of 3½ to 5 feet; 0 to 75 percent slopes.
Low strength; high compressibility; low susceptibility to piping; low permeability after compaction; fair to poor compaction characteristics.	Slow permeability; bedrock is at depth of 1½ to 3½ feet; 5 to 75 percent slopes.	Slow permeability; bedrock is at depth of 1½ to 3½ feet.	Medium water-holding capacity; moderate water intake rate; bedrock is at depth of 1½ to 3½ feet; 5 to 75 percent slopes.	Severe: slow permeability; bedrock is at depth of 1½ to 3½ feet; 5 to 75 percent slopes.
Medium strength; low to medium compressibility; low to medium susceptibility to piping; low permeability after compaction; good to fair compaction characteristics.	Moderate permeability; bedrock is at depth of ½ to 1½ feet; 3 to 75 percent slopes.	Moderate permeability; bedrock is at depth of ½ to 1½ feet.	Low water-holding capacity; moderate water intake rate; bedrock is at depth of ½ to 1½ feet; 3 to 75 percent slopes.	Severe: bedrock is at depth of ½ to 1½ feet; 3 to 75 percent slopes.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Sand and gravel [1]	Road fill	Hydrologic soil group	Soil features affecting— Road location
Moda: MgA, MhA, MkB.	Poor: loam over clay; hardpan is at depth of 1 to 3 feet.	Unsuitable: more than 50 percent fines.	Fair to poor: A-4, A-6, or A-7 material.	D	High shrink-swell potential; hardpan is at depth of 1 to 3 feet; unit MhA is seeped.
Molinos: Mm, Mn, Mo.	Good	Unsuitable: 45 to 55 percent fines; no gravel.	Fair: A-4 material.	B in unit Mn, C in units Mm and Mo.	Unit Mm is channeled; unit Mo is seeped.
Myers: MrA, MrB	Poor: silty clay	Unsuitable: more than 50 percent fines.	Poor: A-7 material.	D	High shrink-swell potential.
*Nanny: NaB, NbB, NcB. For Windy part of unit NcB, see Windy series.	Poor: stony and gravelly sandy loam over very cobbly sandy loam.	Good to fair for sand; 5 to 25 percent fines. Poor for gravel; 25 to 40 percent gravel. 0 to 50 percent cobblestones and stones throughout.	Good	A	0 to 50 percent stones and cobblestones throughout; 0 to 8 percent slopes.
Neuns: NdE, NdG	Poor: very stony or gravelly loam over very gravelly silty clay loam; bedrock is at depth of 1½ to 3½ feet.	Mostly fair to poor for sand; 10 to 45 percent fines. Fair to poor for gravel; 25 to 80 percent gravel. 3 to 15 percent of surface covered by stones.	Good to poor: A-2 or A-6 material.	C	3 to 15 percent of surface covered by stones; greenstone is at depth of 1½ to 3½ feet; 8 to 80 percent slopes.
Newtown: NeC, NeD, NeE2, NfE2.	Poor: gravelly loam and very gravelly clay loam over clay.	Poor for sand and gravel; clay is at depth of 10 to 18 inches.	Good to poor: A-1, A-2, A-6, or A-7 material.	C	1 to 3 percent of surface of NfE2 covered by stones; high shrink-swell potential; 8 to 50 percent slopes.
Parrish: PcD, PcE, PcF.	Poor: loam over gravelly heavy clay loam; bedrock is at depth of 1½ to 3½ feet.	Unsuitable: more than 50 percent fines.	Fair to poor: A-4, A-6, or A-7 material.	C	Meta-andesite is at depth of 1½ to 3½ feet; 8 to 70 percent slopes.

See footnotes at end of table.

properties of the soils—Continued

Soil features affecting—Continued				Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation	Septic tank filter fields
Embankments	Reservoir areas			
Low to medium strength; medium to high compressibility; low to medium susceptibility to piping; low to medium permeability after compaction; fair compaction characteristics.	Very slow permeability; hardpan is at depth of 1 to 3 feet.	Very slow permeability; hardpan is at depth of 1 to 3 feet; unit MhA is seeped.	Low to medium water-holding capacity; moderate water intake rate; hardpan is at depth of 1 to 3 feet; 0 to 5 percent slopes.	Severe: very slow permeability; hardpan is at depth of 1 to 3 feet.
Medium to low strength; low to medium compressibility; medium to high susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderately rapid permeability; unit Mm is channeled.	Moderately rapid permeability; unit Mm is channeled; unit Mo is seeped.	Medium to high water-holding capacity; moderately rapid water intake rate; unit Mm is channeled; unit Mo is seeped.	Slight for unit Mn; severe for unit Mm; channeled; severe for unit Mo; seeped.
Low strength; high compressibility; low susceptibility to piping; low permeability after compaction; fair to poor compaction characteristics.	Slow permeability	Slow permeability	High water-holding capacity; slow water intake rate; 0 to 8 percent slopes.	Severe: slow permeability.
Medium strength; low to medium compressibility; medium to high susceptibility to piping; medium to high permeability after compaction; fair to good compaction characteristics.	Rapid permeability	Rapid permeability	Medium water-holding capacity; rapid water intake rate; 0 to 8 percent slopes.	Slight.[3]
Medium strength; low to medium compressibility; low to medium susceptibility to piping; low permeability after compaction; good to fair compaction characteristics.	Moderate permeability; greenstone is at depth of 1½ to 3½ feet; 8 to 80 percent slopes.	Moderate permeability; greenstone is at depth of 1½ to 3½ feet.	Medium water-holding capacity; moderately rapid water intake rate; greenstone is at depth of 1½ to 3½ feet; 8 to 80 percent slopes.	Severe: bedrock is at depth of 1½ to 3½ feet; 8 to 80 percent slopes.
Medium strength; medium compressibility; low to medium susceptibility to piping; low permeability after compaction; fair to good compaction characteristics.	Slow permeability; 8 to 50 percent slopes.	Slow permeability	Medium water-holding capacity; moderate water intake rate; 8 to 50 percent slopes.	Severe: slow permeability; 8 to 50 percent slopes.
Medium to low strength; medium compressibility; low to medium susceptibility to piping, low permeability after compaction; fair to good compaction characteristics.	Slow permeability; meta-andesite is at depth of 1½ to 3½ feet; 8 to 70 percent slopes.	Slow permeability; meta-andesite is at depth of 1½ to 3½ feet.	Medium water-holding capacity; moderate water intake rate; meta-andesite is at depth of 1½ to 3½ feet; 8 to 70 percent slopes.	Severe: slow permeability; bedrock is at depth of 1½ to 3½ feet; 8 to 70 percent slopes.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of —			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel [1]	Road fill		Road location
*Pentz: PfF. For Supan part, see Supan series.	Poor: fine sandy loam over very gravelly sandy loam; bedrock is at depth of ½ to 1½ feet.	Unsuitable: bedrock is at depth of ½ to 1½ feet.	Good: A–1 material.	D	Decomposed tuff is at depth of ½ to 1½ feet; 50 to 70 percent slopes.
Perkins: PlA	Fair: loam over clay loam.	Unsuitable: more than 50 percent fines.	Fair to poor: A–4 or A–6 material.	C	Most features are favorable.
PmA, PmB, PmC, PmD, PnA, PoA, PoB.	Fair: gravelly loam over gravelly clay loam.	Poor for sand; 35 to 50 percent fines. Poor to unsuitable for gravel; 15 to 30 percent gravel.	Fair to poor: A–4 or A–6 material.	C	Weakly cemented material at depth of 2 to 3 feet in units PoA and PoB; unit PnA is seeped; 0 to 30 percent slopes.
Red Bluff: RbA, RbB	Poor: clay loam over clay.	Unsuitable: more than 50 percent fines.	Poor: A–6 or A–7 material.	B	Most features are favorable.
RcA, RcB	Poor: gravelly loam over gravelly clay.	Poor to unsuitable for sand; 35 to 55 percent fines. Poor to unsuitable for gravel; 20 to 50 percent gravel.	Fair to poor: A–4, A–6, or A–7 material.	C	Consolidated cobbly clay is at depth of 2 to 3 feet.
*Redding: RdA, RdB, ReA, ReB. For Red Bluff parts of units ReA and ReB, see units RcA and RcB of the Red Bluff series.	Poor: gravelly loam over clay; hardpan is at depth of 1 to 2½ feet.	Unsuitable: mostly more than 50 percent fines.	Fair to poor: A–4 or A–7 material.	D	Hardpan is at depth of 1 to 2½ feet.

See footnotes at end of table.

properties of the soils—Continued

Soil features affecting—Continued				Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation	Septic tank filter fields
Embankments	Reservoir areas			
Medium strength; low to medium compressibility; medium to high susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderately rapid permeability; decomposed tuff is at depth of ½ to 1½ feet; 50 to 70 percent slopes.	Moderately rapid permeability; decomposed tuff is at depth of ½ to 1½ feet.	Low water-holding capacity; moderately rapid water intake rate; decomposed tuff is at depth of ½ to 1½ feet; 50 to 70 percent slopes.	Severe: bedrock is at depth of ½ to 1½ feet; 50 to 70 percent slopes.
Medium to low strength; medium compressibility; low to medium susceptibility to piping; low permeability after compaction; fair to good compaction characteristics.	Slow permeability	Slow permeability	High water-holding capacity; medium water intake rate.	Severe: slow permeability.
Medium strength; low to medium compressibility; low to medium susceptibility to piping; low permeability after compaction; good to fair compaction characteristics.	Slow permeability; weakly cemented material at depth of 2 to 3 feet in units PoA and PoB; 0 to 30 percent slopes.	Slow permeability; weakly cemented material at depth of 2 to 3 feet in units PoA and PoB; unit PnA is seeped.	Medium to high water-holding capacity; medium water intake rate; units PoA and PoB have weakly cemented material at depth of 2 to 3 feet; 0 to 30 percent slopes.	Severe: slow permeability.
Medium to low strength; medium compressibility; medium to low susceptibility to piping; low permeability after compaction; good to fair compaction characteristics.	Moderately slow permeability.	Moderately slow permeability.	High water-holding capacity; moderate water intake rate; 0 to 8 percent slopes.	Severe: moderately slow permeability.
Medium to low strength; low to medium compressibility; low to medium susceptibility to piping; low permeability after compaction; fair to good compaction characteristics.	Slow permeability; consolidated cobbly clay is at depth of 2 to 3 feet.	Slow permeability; consolidated cobbly clay is at depth of 2 to 3 feet.	Medium water-holding capacity; moderate water intake rate; consolidated cobbly clay is at depth of 2 to 3 feet; 0 to 8 percent slopes.	Severe: slow permeability.
Medium to low strength; medium to high compressibility; low to medium susceptibility to piping; low permeability after compaction; fair compaction characteristics.	Very slow permeability; hardpan is at depth of 1 to 2½ feet.	Very slow permeability; hardpan is at depth of 1 to 2½ feet.	Low water-holding capacity; moderately rapid water intake rate; hardpan is at depth of 1 to 2½ feet; 0 to 8 percent slopes.	Severe: very slow permeability; hardpan is at depth of 1 to 2½ feet.

TABLE 6.—*Interpretatons of engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Sand and gravel [1]	Road fill	Hydrologic soil group	Soil features affecting - Road location
Reiff:					
RfB, RhA	Fair to poor: sandy loam and fine sandy loam over very gravelly sand.	Good to fair for sand; 0 to 25 percent fines. Fair for gravel below depth of 40 inches; 60 to 70 percent gravel.	Good	B	Very gravelly sand below depth of 3½ to 5 feet.
RgA, RgB	Good	Poor to good for sand; 20 to 45 percent fines. Unsuitable for gravel; 0 to 5 percent gravel.	Fair to good: A–2 or A–4 material.	B	Most features are favorable.
RkA	Fair to poor: gravelly fine sandy loam over very gravelly sand.	Fair to good for sand; 20 to 35 percent fines. Fair to poor for gravel; 25 to 70 percent gravel.	Good	B	Very gravelly sand below depth of 3½ to 5 feet.
RlA, RmA	Good	Unsuitable: more than 50 percent fines.	Fair: A–4 material.	B	Unit RmA is seeped
RnA, RoA	Fair: gravelly loam.	Poor for sand; 35 to 45 percent fines. Poor for gravel; 25 to 50 percent gravel.	Fair: A–4 material.	B	Unit RoA is slightly wet.
Riverwash: Rw. Too variable for valid interpretations.					
Rock land: RxF. Too variable for valid interpretations.					
Rubble land: RyF. Too variable for valid interpretations.					

See footnotes at end of table.

properties of the soils—Continued

Soil features affecting—Continued				Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation	Septic tank filter fields
Embankments	Reservoir areas			
Medium to high strength; low to medium compressibility; medium to low susceptibility to piping; medium to high permeability after compaction; fair to good compaction characteristics.	Very rapid permeability; unit RfB is channeled.	Very rapid permeability; unit RfB is channeled.	Medium water-holding capacity; moderately rapid water intake rate; 0 to 8 percent slopes; unit RfB is channeled; very gravelly sand below depth of 3½ to 5 feet.	Severe: for RfB; slight for RhA.[3]
Medium shear strength; low to medium compressibility; medium to high susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderately rapid permeability.	Moderately rapid permeability.	High water-holding capacity; moderate water intake rate; 0 to 8 percent slopes.	Slight.
Medium to high strength; low to medium compressibility; medium to low susceptibility to piping; medium to high permeability after compaction; fair to good compaction characteristics.	Very rapid permeability.	Very rapid permeability.	Medium water-holding capacity; moderately rapid water intake rate; very gravelly sand below depth of 3½ to 5 feet.	Slight.[3]
Medium to low strength; medium compressibility; high susceptibility to piping; medium to low permeability after compaction; fair to poor compaction characteristics.	Moderate permeability.	Moderate permeability; unit RmA is seeped.	High water-holding capacity; moderate water intake rate; unit RmA is seeped.	Slight for RlA; severe for RmA, seeped.
Medium strength; low to medium compressibility; medium to high susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderately rapid permeability.	Moderately rapid permeability; unit RoA is slightly wet.	Medium to high water-holding capacity; moderately rapid water intake rate; unit RoA is slightly wet.	Slight for RnA; moderate for RoA; water table is at depth of 4 to 5 feet.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of —			Hydrologic soil group	Soil features affecting —
	Topsoil	Sand and gravel [1]	Road fill		Road location
Sehorn: ScB, ScD, ScE, SdD2, SeD, SeE, SfF2.	Poor: clay; bedrock is at depth of 1½ to 4 feet.	Unsuitable: more than 50 percent fines.	Poor: A–7 material.	D	High shrink-swell potential; 3 to 15 percent of surface of SdD2 covered by stones; shale is at depth of 1½ to 4 feet; 3 to 70 percent slopes.
Sheetiron: SgE, SgF, SgG.	Poor: very gravelly loam; bedrock is at depth of 1½ to 3½ feet.	Fair for sand; 25 to 35 percent fines. Poor for gravel; 40 to 50 percent gravel.	Good	C	3 to 15 percent of surface covered by stones; slate is at depth of 1½ to 3½ feet; 30 to 90 percent slopes.
Shingletown: ShB	Fair: clay loam and sandy clay loam.	Unsuitable: mostly more than 50 percent fines.	Poor: A–6 material.	C	Water table is at depth of 3 to 5 feet.
SkA	Fair: loam over sandy clay loam.	Poor to unsuitable for sand; 35 to 60 percent fines. Poor to unsuitable for gravel; 0 to 40 percent gravel.	Poor: A–6 material.	B	Most features are favorable.
Sierra: SmB, SmC, SmD, SmD3, SmE.	Fair: sandy loam and loam over clay loam; bedrock is at depth of 3½ to more than 5 feet.	Unsuitable: mostly more than 50 percent fines.	Fair to poor: A–4, A–6, or A–7 material.	B	Granodiorite is at depth of 3½ to more than 5 feet; 3 to 50 percent slopes.
Sites: SnC, SnD, SnE, SnF, SoD, SpE.	Fair to poor: loam and clay loam over clay; bedrock is at depth of 4 to more than 5 feet.	Unsuitable: more than 50 percent fines.	Fair to poor: A–4, A–6, or A–7 material.	B	1 to 3 percent of surface of SoD covered by stones; sandstone is at depth of 4 to more than 5 feet; 5 to 70 percent slopes.
Spreckels: SrA, SrB	Poor: fine sandy loam and loam over clay; hardpan is at depth of 1½ to 3 feet.	Unsuitable: mostly more than 50 percent fines.	Fair to poor: A–4 or A–7 material.	C	High shrink-swell potential; hardpan is at depth of 1½ to 3 feet.

See footnotes at end of table.

properties of the soils—Continued

Soil features affecting—Continued				Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation	Septic tank filter fields
Embankments	Reservoir areas			
Low strength; high compressibility; low susceptibility to piping; low permeability after compaction; fair to poor compaction characteristics.	Slow permeability; shale is at depth of 1½ to 4 feet; 3 to 70 percent slopes.	Slow permeability; shale is at depth of 1½ to 4 feet.	Low to medium water-holding capacity; slow water intake rate; shale is at depth of 1½ to 4 feet; 3 to 70 percent slopes.	Severe: slow permeability; bedrock is at depth of 1½ to 4 feet; 3 to 70 percent slopes.
Medium to high strength; low compressibility; medium to low susceptibility to piping; medium to low permeability after compaction; good to fair compaction characteristics.	Moderately rapid permeability; slate is at depth of 1½ to 3½ feet; 30 to 90 percent slopes.	Moderately rapid permeability; slate is at depth of 1½ to 3½ feet.	Low to medium water-holding capacity; rapid water intake rate; slate is at depth of 1½ to 3½ feet; 30 to 90 percent slopes.	Severe: bedrock is at depth of 1½ to 3½ feet; 30 to 90 percent slopes.
Medium to low strength; medium compressibility; medium susceptibility to piping; medium to low permeability after compaction; fair to good compaction characteristics.	Moderately slow permeability.	Moderately slow permeability; water table is at depth of 3 to 5 feet.	High water-holding capacity; moderately slow water intake rate; water table is at depth of 3 to 5 feet; 0 to 8 percent slopes.	Severe: moderately slow permeability; water table is at depth of 3 to 5 feet; bedrock is at depth of 3½ to more than 5 feet.
Medium to low strength; medium compressibility; medium susceptibility to piping; low permeability after compaction; fair to good compaction characteristics.	Moderately slow permeability.	Moderately slow permeability.	High water-holding capacity; moderate water intake rate; 0 to 3 percent slopes.	Severe: moderately slow permeability.
Medium to low strength; medium compressibility; medium susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderately slow permeability; granodiorite is at depth of 3½ to more than 5 feet; 3 to 50 percent slopes.	Moderately slow permeability; granodiorite is at depth of 3½ to more than 5 feet.	Medium to high water-holding capacity; moderate water intake rate; granodiorite is at depth of 3½ to more than 5 feet; 3 to 50 percent slopes.	Severe: moderately slow permeability; bedrock is at depth of 3½ to more than 5 feet; 3 to 50 percent slopes.
Medium to low strength; medium compressibility; medium susceptibility to piping; medium to low permeability after compaction; fair to good compaction characteristics.	Moderately slow permeability; sandstone is at depth of 4 to more than 5 feet; 5 to 70 percent slopes.	Moderately slow permeability; sandstone is at depth of 4 to more than 5 feet.	High water-holding capacity; moderate water intake rate; sandstone is at depth of 4 to more than 5 feet; 5 to 70 percent slopes.	Severe: moderately slow permeability; bedrock is at depth of 4 to more than 5 feet; 5 to 70 percent slopes.
Low to medium strength; medium to high compressibility; low to medium susceptibility to piping; low permeability after compaction; fair compaction characteristics.	Very slow permeability; hardpan is at depth of 1½ to 3 feet.	Very slow permeability; hardpan is at depth of 1½ to 3 feet.	Medium water-holding capacity; moderate water intake rate; hardpan is at depth of 1½ to 3 feet; 0 to 8 percent slopes.	Severe: very slow permeability; hardpan is at depth of 1½ to 3 feet.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Sand and gravel [1]	Road fill	Hydrologic soil group	Soil features affecting— Road location
Stonyford: SsE, SsG.	Poor: gravelly loam over gravelly clay loam; bedrock is at depth of 1½ to 2 feet.	Unsuitable: bedrock is at depth of 1½ to 2 feet.	Poor: A–6 material.	D	3 to 10 percent of surface covered by stones; greenstone is at depth of 1½ to 2 feet; 30 to 75 percent slopes.
Supan: StC, StD, StE, SuD, SuE.	Poor: loam to gravelly loam over gravelly clay loam; bedrock is at depth of 2 to 3½ feet.	Poor to unsuitable for sand; 35 to 50 percent fines. Poor to unsuitable for gravel; 10 to 30 percent gravel.	Fair to poor: A–4 or A–6 material.	C	3 to 10 percent of surface of units SuD and SuE covered by stones; decomposed tuff is at depth of 2 to 3½ feet; 0 to 50 percent slopes.
Tailings and Placer diggings: TaD. Too variable for valid interpretations.					
Tehama: TbA, TbB, TbC.	Fair: loam over silty clay and very gravelly clay loam.	Unsuitable to a depth of 45 inches: over 50 percent fines. Fair for sand below; 10 to 25 percent fines. Fair for gravel below; 50 to 80 percent gravel.	Fair to poor over good: A–4 or A–7 over A–2 material.	C	0 to 15 percent slopes.
Toomes: TcE, TeD.	Poor: stony loam; bedrock is at depth of ½ to 1½ feet.	Unsuitable: decomposed tuff is at depth of ½ to 1½ feet.	Fair to poor: A–4 or A–6 material.	D	10 to 20 percent stones; decomposed tuff is at depth of ½ to 1½ feet; 0 to 50 percent slopes.
Tujunga: TfA, TfB.	Poor: loamy sand and sand over very gravelly and very cobbly sand.	Good for sand. Fair to unsuitable for gravel; 0 to 65 percent gravel.	Good	A	Very gravelly and very cobbly sand below depth of 3 to 5 feet.
Tuscan: ThA, ThB.	Poor: cobbly clay loam; hardpan is at depth of ½ to 1½ feet.	Unsuitable: hardpan is at depth of ½ to 1½ feet; gravelly and cobbly alluvium below hardpan.	Fair: A–4 material.	D	15 to 25 percent cobblestones; hardpan is at depth of ½ to 1½ feet.

See footnotes at end of table.

properties of the soils—Continued

Soil features affecting—Continued					Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation		Septic tank filter fields
Embankments	Reservoir areas				
Medium strength; low to medium compressibility; medium susceptibility to piping; low to medium permeability after compaction; good to fair compaction characteristics.	Moderate permeability; greenstone is at depth of 1½ to 2 feet; 30 to 75 percent slopes.	Moderate permeability; greenstone is at depth of 1½ to 2 feet.	Low water-holding capacity; moderate water intake rate; greenstone is at depth of 1½ to 2 feet; 30 to 75 percent slopes.		Severe: greenstone is at depth of 1½ to 2 feet; 30 to 75 percent slopes.
Medium strength; low to medium compressibility; medium susceptibility to piping; low to medium permeability after compaction; good to fair compaction characteristics.	Moderately slow permeability; decomposed tuff is at depth of 2 to 3½ feet; 0 to 50 percent slopes.	Moderately slow permeability; decomposed tuff is at depth of 2 to 3½ feet.	Medium water-holding capacity; moderate water intake rate; decomposed tuff is at depth of 2 to 3½ feet; 0 to 50 percent slopes.		Severe: moderately slow permeability; bedrock is at depth of 2 to 3½ feet; 0 to 50 percent slopes.
Medium strength; medium compressibility; medium to low susceptibility to piping; medium to low permeability after compaction; good to fair compaction characteristics.	Slow permeability; 0 to 15 percent slopes.	Slow permeability	High water-holding capacity; moderate water intake rate; 0 to 15 percent slopes.		Severe: Slow permeability.
Medium to low strength; medium compressibility; medium susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderate permeability; decomposed tuff is at depth of ½ to 1½ feet; 0 to 50 percent slopes.	Moderate permeability; decomposed tuff is at depth of ½ to 1½ feet.	Low water-holding capacity; moderate water intake rate; decomposed tuff is at depth of ½ to 1½ feet; 0 to 50 percent slopes.		Severe: decomposed tuff is at depth of ½ to 1½ feet; 0 to 50 percent slopes.
Medium to high strength; low compressibility; medium to low susceptibility to piping; medium to high permeability after compaction; good to fair compaction characteristics.	Very rapid permeability	Very rapid permeability	Low water-holding capacity; rapid water intake rate; 0 to 8 percent slopes.		Slight.[2]
Medium strength; medium to low compressibility; medium susceptibility to piping; medium to low permeability after compaction; fair to good compaction characteristics.	Very slow permeability; hardpan is at depth of ½ to 1½ feet.	Very slow permeability; hardpan is at depth of ½ to 1½ feet.	Low water-holding capacity; moderately slow water intake rate; hardpan is at depth of ½ to 1½ feet; 0 to 8 percent slopes.		Severe: very slow permeability; hardpan is at depth of ½ to 1½ feet.

TABLE 6.—*Interpretations of engineering*

Soil series and map symbols	Suitability as source of—			Hydrologic soil group	Soil features affecting—
	Topsoil	Sand and gravel [1]	Road fill		Road location
Vina: VeA, VfA	Good	Unsuitable: more than 50 percent fines.	Fair: A-4 material.	B for unit VeA, C for unit VfA.	Unit VfA is seeped; most other features are favorable.
VgB	Fair: gravelly loam.	Poor for sand; 40 to 50 percent fines. Poor for gravel; 25 to 45 percent gravel.	Fair: A-4 material.	B	Most features are favorable.
Wet alluvial land: Wa. Too variable for valid interpretations.					
*Windy: WeD, WfE, WfG, WgE. For McCarthy part of all units, see McCarthy series.	Poor: stony sandy loam and very gravelly sandy loam; bedrock is at depth of 3½ to 5 feet.	Good to fair for sand; 5 to 35 percent fines. Fair to unsuitable for gravel; 5 to 60 percent gravel.	Good	B	1 to 10 percent of surface covered by stones; volcanic rock is at depth of 3½ to 5 feet; 0 to 75 percent slopes.

[1] Fines mentioned in this column refer to material that passes a No. 200 sieve.
[2] Contamination of ground water may result where septic tank filter fields are installed.

properties of the soils—Continued

Soil features affecting—Continued					Degree and kind of limitation for—
Water retention structures		Agricultural drainage	Irrigation		Septic tank filter fields
Embankments	Reservoir areas				
Medium to low strength; medium compressibility; high susceptibility to piping; medium to low permeability after compaction; good to poor compaction characteristics.	Moderate permeability	Moderate permeability; unit VfA is seeped.	High water-holding capacity; moderate water intake rate; unit VfA is seeped.		Moderate for VeA, moderate permeability; severe for VfA, seeped.
Medium strength; low to medium compressibility; medium susceptibility to piping; low to medium permeability after compaction; fair to good compaction characteristics.	Moderate permeability	Moderate permeability	Medium to high water-holding capacity; moderate water intake rate; 3 to 8 percent slopes.		Moderate: moderate permeability.
High to medium strength; low compressibility; low susceptibility to piping; high permeability after compaction; good compaction characteristics.	Rapid permeability; volcanic rock is at depth of 3½ to 5 feet; 0 to 75 percent slopes.	Rapid permeability; volcanic rock is at depth of 3½ to 5 feet.	Medium water-holding capacity; rapid water intake rate; volcanic rock is at depth of 3½ to 5 feet; 0 to 75 percent slopes.		Severe: bedrock is at depth of 3½ to 5 feet; 0 to 75 percent slopes.

[8] Percentage of gravel is on a weight basis.

TABLE 7. *Engineering*

[Tests were performed by District II, California Division of Highways, in accordance with methods described in "California

Soil name and location	Parent material	California report No.	Depth	Moisture-density [1]: Maximum dry density	Moisture-density [1]: Optimum moisture	Mechanical analysis [2]: Material 3- to 10-in. in diam. discarded in field sampling (estimated)	Percentage passing sieve—1½-in.	Percentage passing sieve—1-in.	Percentage passing sieve—¾-in.
			Inches	*Lb. per cubic ft.*	*Percent*	*Percent*			
Auburn gravelly loam: 1,000 feet east-southeast of center of sec. 8, T. 31 N., R. 5 W.	Metamorphosed basic igneous rocks.	D-25461	0-5	109	17			100	99
		D-25462	13-27	108	19			100	94
Chaix coarse sandy loam: 2,000 feet north of northeast corner, sec. 6, T. 30 N., R. 7 W.	Quartz diorite.	D-25464	0-9	118	12				
Churn gravelly loam: ¼ mile east of southwest corner, sec. 3, T. 29 N., R. 5 W.	Alluvium.	D-25466	0-10	123	10		100	99	96
		D-25467	18-39	123	12			100	99
Cone gravelly loam: 400 feet west of S¼ corner, sec. 8, T. 30 N., R. 1 W.	Black volcanic cinders.	D-25470	0-7	84	30			100	99
		D-25471	7-58	88	23		100	99	99
		D-25472	58-80+	99	19			100	98
Kilarc very stony sandy clay loam: ¼ mile northeast of W¼ corner, sec. 23, T. 32 N., R. 1 W.	Sandstone.	D-25479	0-10	114	14	15	100	97	95
		D-25480	10-24	98	22				
Los Robles loam: 1,100 feet north of W¼ corner, sec. 20, T. 31 N., R. 3 W.	Alluvium.	D-25482	25-40	114	15				
Newtown gravelly loam: 1,300 feet north-northwest of southeast corner, sec. 34, T. 30 N., R. 5 W.	Alluvium (old terraces).	D-25484	0-8	131	10	15	[6] 92	85	80
		D-25485	18-35	115	15			100	99
Parrish loam: Center of NW¼, sec. 8, T. 30 N., R. 7 W.	Greenstone (meta-andesite).	D-25493	0-9	115	13		[6] 99	98	98
		D-25494	9-30	113	13				
Perkins gravelly loam: 500 feet east of northwest corner, sec. 7, T. 29 N., R. 4 W.	Alluvium.	D-25487	0-10	127	10		[6] 99	99	97
		D-25488	32-54	119	12			100	99
		D-25489	54-60	125	10		[6] 99	95	92
Red Bluff gravelly loam: 1,000 feet east and 100 feet south of N¼ corner, sec. 27, T. 31 N., R. 4 W.	Alluvium.	D-25490	0-6	121	12				100
		D-25491	28-57	115	14				100
		D-25492	57-67	117	14				
Reiff fine sandy loam: ½ mile east of northwest corner, sec. 9, T. 30 N., R. 4 W.	Alluvium.	D-25473	0-8	113	16				
		D-25474	18-62+	114	14				
Sehorn silty clay: 300 feet south of N¼ corner, sec. 20, T. 32 N., R. 2 W.	Shale.	D-25459	0-11	101	21				
		D-25460	20-28	101	20				
Supan gravelly loam: ⅛ mile east of southwest corner, sec. 18, T. 31 N., R. 2 W.	Andesitic tuff.	D-25476	0-6	118	13	15	[6] 97	95	92

See footnotes at end of table.

test data

Materials Manual for Testing and Control Procedures" (4). Absence of information indicates that no determination was made]

Mechanical analysis [2]—Continued								Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued						Percentage smaller than—				AASHO [3]	Unified [4]
⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.005 mm.	0.001 mm.	*Percent*			
96	94	89	77	72	60	26	8	31	8	A-4(5)	ML-CL
92	91	82	67	62	54	29	15	34	9	A-4(4)	ML-CL
100	97	77	49	42	30	6	0	[5] NP	NP	A-2-4(0)	SM
83	75	68	54	49	36	11	4	21	4	A-4(0)	SM-SC
96	93	88	78	74	54	34	18	25	11	A-6(4)	CL
89	72	57	47	43	35	1	0	NP	NP	A-2-4(0)	SM
93	79	61	46	42	31	5	0	NP	NP	A-2-4(0)	SM
86	61	33	20	17	11	0	0	NP	NP	A-1-a(0)	SP-SM
93	89	82	67	58	39	20	18	28	7	A-4(1)	SM-SC
-------	100	99	93	90	77	69	56	62	37	A-7-6(20)	CH
-------	-------	100	94	87	63	36	25	33	15	A-6(8)	CL
71	64	53	37	32	22	9	4	NP	NP	A-1-b(0)	SM
98	93	88	75	69	54	23	20	39	20	A-6(8)	CL
97	96	93	84	77	57	27	13	29	7	A-4(4)	ML-CL
-------	[7] 100	98	90	85	70	38	26	36	16	A-6(9)	CL
93	88	82	61	54	41	11	5	25	10	A-4(1)	SC
96	93	88	61	50	36	34	27	34	18	A-6(2)	SC
85	79	70	53	47	32	26	18	34	20	A-2-6(2)	SC
97	90	77	54	47	37	25	13	31	12	A-6(1)	SC
99	96	93	84	80	68	49	34	45	27	A-7-6(14)	CL
100	99	97	87	82	69	47	31	37	18	A-6(10)	CL
-------	-------	100	96	89	40	6	0	NP	NP	A-4(1)	SM
-------	-------	100	93	84	25	3	0	NP	NP	A-2-4(0)	SM
-------	-------	100	98	96	95	64	33	71	49	A-7-6(20)	CH
-------	100	98	87	82	75	41	17	67	43	A-7-6(20)	CH
87	83	78	58	50	38	15	5	30	10	A-4(1)	SC

490 726 74 10

TABLE 7.—*Engineering*

Soil name and location	Parent material	California report No.	Depth	Moisture-density [1]: Maximum dry density	Moisture-density [1]: Optimum moisture	Mechanical analysis [2]: Material 3- to 10-in. in diam. discarded in field sampling (estimated)	Mechanical analysis [2]: Percentage passing sieve— 1½-in.	Percentage passing sieve— 1-in.	Percentage passing sieve— ¾-in.
			Inches	*Lb. per cubic ft.*	*Percent*	*Percent*			
Tuscan cobbly loam: 200 feet southeast of northwest corner, sec. 36, T. 30 N., R. 3 W.	Alluvium from Tuscan formation.	D–25496	0–16	125	11	25	[6] 98	95	92

[1] Based on the method of test for relative compaction of untreated and treated soils and aggregates, test method No. Calif. 216E.
[2] Mechanical analyses by California Division of Highways. The procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the California procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

Shrink-swell potential is the relative change in volume to be expected of soil material as the moisture content changes, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil and the coefficient of linear extensibility. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. The shrink-swell ratings in table 5 are an indication of the hazard to structures resulting from this volume change. A rating of *low* indicates that the soil is not subject to or is only slightly subject to shrinking and swelling and is more suitable as a site for construction than other soils if other features are favorable. A rating of *moderate* or *high* indicates a greater shrink-swell potential. Such a rating does not mean that a structure cannot be built, but it is a warning that shrinking and swelling are hazards.

Corrosivity to uncoated steel pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel. The rate of corrosion of uncoated steel is related to soil properties, such as drainage, texture, total acidity, and electrical conductivity of the soil material. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. The depth to which a pipe or other item of steel is buried can affect the rate and extent of corrosion. Ratings for corrosivity are based on soil in its natural state and do not consider the effects of other factors, such as amount of soil water or adding fertilizer or salts to the soil. Corrosion to untreated steel pipes or other items of steel is likely to be increased by electrical leaks from underground cable and by electrical charges resulting from dissimilar composition of metals. Ratings of *low*, *moderate*, and *high* are based on the soil texture, drainage class, and total acidity, and on conductivity of the saturation extract. A corrosivity rating of *low* means that there is only a slight probability of soil-induced corrosion damage. A rating of *moderate* indicates a greater probability. A rating of *high* means that there is a high probability of damage, so that protective measures should be used to avoid or minimize damage.

Engineering interpretations of soils

The soil interpretations in table 6 are based on the engineering properties of soils shown in table 5, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of the Shasta County Area. In table 6 ratings are used to summarize limitations to use of the soils for all listed purposes other than for agricultural drainage, water retention structures, irrigation, and road location. For these particular uses, table 6 shows soil features that should not be overlooked in planning, installation, and maintenance.

Ratings are given for the suitability of the soil material for topsoil, sand and gravel, and road fill. The ratings are *good*, *fair*, and *poor*.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of workability and spreadability of the soil material in preparing a seedbed; response of plants when fertilizer is applied; and thickness of material. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that results at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 6 provide guidance about where to look for probable sources. The suitability ratings are based on the percentage of fines or gravel present in the soil. The ratings do not take into account thickness of overburden, location of the water table, thickness of layers, or other factors that affect mining of the materials. Also, the ratings do not indicate the quality of the deposit.

Road fill is soil material used as subgrade or in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil used for subgrade or after

test data -Continued

Mechanical analysis [2]—Continued											
Percentage passing sieve—Continued						Percentage smaller than—		Liquid limit	Plasticity index	Classification	
⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.005 mm.	0.001 mm.			AASHO [3]	Unified [4]
								Percent			
84	79	72	60	52	36	17	9	23	4	A-4(0)	SM-SC

[3] Based on AASHO Designation M 145-49 (*1*).
[4] Based on the Unified soil classification system (*18*). SCS and Bureau of Public Roads (BPR) have agreed to consider that all soils having plasticity indexes within 2 points from A-line are to be given a borderline classification. An example is ML-CL.
[5] NP=Nonplastic.
[6] 100 percent passed the 2-inch sieve.
[7] Gravel discarded from sample.

it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas. Suitability ratings for road fill are based on the estimated AASHO classifications given in table 5.

The Soil Conservation Service has devised a method of grouping soils for hydrologic purposes. It is based on the intake of water at the end of long-duration storms occurring after prior wetting, opportunity for swelling, and without the protective effects of vegetation. Each soil profile in the table is rated A, B, C, or D. In broad terms, group A soils have the least amount of runoff, and group D soils the most. Groups B and C are gradations between these two. Additional information on the subject of rainfall infiltration is available in the U.S. Department of Agriculture Yearbook for 1955 (*15*) and in the SCS National Engineering Handbook, "Hydrology" (*17*).

Some features that adversely affect the location of roads are stones and rocks on and in the soil, slope, shrink-swell potential, topography, and susceptibility to flooding. These features were considered in relation to secondary roads and streets under the heading "Road location." Major highways were not included in the consideration.

Embankments, dikes, and levees require that soil material be resistant to seepage and piping and that such characteristics as stability, shear strength, and compactibility be favorable. Presence of stones or organic material in a soil are among the unfavorable factors.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to permeability and depth to fractured or permeable bedrock or other permeable material. Slope also affects the use of soils for this purpose.

Agricultural drainage is affected by such soil properties as permeability, depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Soil features considered in table 6 with reference to suitable irrigation practices for a soil are: slope, depth of root zone, rate of water intake at the surface, claypans, amount of water available to plants, and depth to bedrock.

Septic tank filter fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The most restrictive layer in the profile is evaluated. The soil properties considered are those that affect absorption of effluent and construction and operation of the system. Properties that effect absorption are permeability, depth to water table or bedrock, and susceptibility to flooding. Slope is a soil property that affects layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Soil limitations are indicated by the ratings *slight*, *moderate*, and *severe*. *Slight* means that soil properties generally are favorable for the rated use, or in other words, limitations are minor and are easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation and special design.

Engineering test data

Table 7 shows the engineering test data for several soil series sampled in stated sites within the survey area. The test data indicate engineering characteristics of the soil at specific locations. It must be recognized that there are variations in the physical characteristics of the soil at other locations. Most of the data fall within the estimated range of properties listed in table 5.

General soil conditions by geomorphic provinces

The section "Formation and Classification of the Soils" briefly describes the geology of the survey area. Some generalizations pertaining to engineering works can be drawn from this information. Four geomorphic provinces—the

Cascade Range, Klamath Mountains, Coast Range, and Great Valley of California are discussed.

The Cascade province is characterized by soils that have a relatively porous substratum. In this area sites for foundations for proposed water retention structures should be carefully investigated. Some faultlines are noticeable in the area, but they are less numerous than in the Klamath province. Soils in watersheds at higher elevations are generally very porous and have little surface runoff. Much of the subsurface flow returns at lower elevations to form perennial streams. Many soils below the timberline have large amounts of runoff, but erosion generally is slight. The Cascade province contains the principal source of cinders in the survey area.

The Klamath province contains a large number of faultlines, most of which are located in an area north of the Whiskeytown Reservoir. Many of the soils are shallow and highly susceptible to erosion if protective vegetation is removed. Large amounts of runoff, along with large amounts of sediment, can be expected.

The Coast Range province also has large amounts of surface runoff. Few faultlines are apparent in the area. Deeply weathered shale, generally dipping to the east, causes foundation seepage and a lack of stability in water-retention structures in places.

Much of the Great Valley province is farmed. High and intermediate terraces generally have large amounts of surface runoff. They are characterized by soils that have slow or very slow permeability and that are commonly underlain by a hardpan. Low terraces form somewhat of a transition between these and recent valley alluvium. The recent alluvium is along the Sacramento River and its major tributaries. It provides the main source of concrete aggregate in the survey area.

Formation and Classification of Soils [6]

This section describes the major factors of soil formation and tells how these factors have affected the soils of the Shasta County Area. It also explains the current system for classifying soils and places the soil series represented in the survey area in some categories of that system.

Factors of Soil Formation

Soil as a natural formation on the earth's surface is composed of organic and mineral materials in which plants grow. Soils differ in appearance, composition, management requirements, and productivity in different localities, commonly within short distances. The factors that cause soils to differ are (1) the physical and mineralogical composition of the parent material of the soil; (2) the relief or lay of the land; (3) the climate under which the soil material has accumulated; (4) the biological activity, including the plant and animal life in and on the soil; and (5) the length of time the forces of formation have acted on the soil material. Each soil is affected by all five factors, but the relative effect and importance of each factor varies from one soil to another.

[6] By S. Burkett Johnson, soil specialist, Soil Conservation Service, retired.

Parent material and relief

The geology and the geomorphic history of the survey area help to explain the relationship of parent material and relief to the formation of soils. The Shasta County Area is in four geomorphic provinces—the Cascade Range, the Klamath Mountains, the Coast Range, and the Great Valley of California. The Cascade Range extends from the vicinity of Big Bend southward and eastward beyond the boundary of the survey area. The Klamath Mountains cover the northwestern part of the survey area from Platina to Shasta Dam. The Coast Range extends into the southwestern corner of the survey area from Platina to Igo and includes the Bald Hills. The northernmost tip of the Great Valley of California extends into the survey area as far as Project City and includes the terraces and alluvial flood plains (*13*).

Cascade Range.—In the Cascade Range of California, large gently sloping volcanoes were built by outpourings of highly liquid basaltic lava (*13*). Also, numerous smaller cones formed along faults as lava flows issued along these zones of weakness in the underlying rock formations. Probably most of the basalt and andesite flows in the survey area originated in Mt. Lassen or in nearby lesser cones. Explosion debris also covered a few areas. Although the volcanoes are nearly extinct, this volcanic activity has persisted into modern times. Mt. Shasta erupted in 1786 (*13*), and Mt. Lassen erupted as late as 1917.

Along with the massive basalts and andesites, a large amount of andesitic and rhyolitic tuffs were extruded. Most of these tuffs were deposited in the form of tuff-breccia. Large amounts of these original rocks have eroded away. The shallow Toomes soils and the deep Supan soils are on the harder rocks in this area. Supan soils formed in weakly cemented and more easily weathered layers of tuff.

The basalt and andesite flows generally form broad plateaus, and the lower edges are dissected by canyons. At intermediate elevations these rock formations are deeply weathered, and the Aiken and Cohasset soils formed in these areas. At higher elevations soils that have had little weathering are exemplified by the Windy and McCarthy soils. On nearby glacial outwash are the Nanny soils. At lower elevations the soils on recent basalts are represented by the moderately weathered Guenoc soils. Along with Guenoc soils, Cone soils formed in the porous gravel of the explosion debris. Cone soils have little profile formation. Soils on the lighter colored dacite and rhyolite are represented by the Forward and Lyonsville soils.

Erosion of the andesite and basalt flows has exposed shale, sandstone, and slate. The soils that characterize these areas containing shale and sandstone are the Gaviota, Kilarc, and Sehorn series. Soils of the Josephine, Marpa, and Sites series formed in slate and shale. These formations exposed by erosion of volcanic rocks are related to some of the formations of the Coast Range geomorphic province. These formations also underlie the Great Valley of California and parts of the Cascade Range.

Fertility of the soils that formed on the rocks of the Cascade Range generally is high because the rocks are probably because the sediment in the rocks was weathered weatherable minerals. Differences in productivity of these soils depend more on relief, age of the lava flow, and climate than on other factors.

Klamath Mountains.—When viewed from a high peak, the ridgetops of the Klamath Mountains appear to be similar in elevation, and the entire area appears as a former landscape that has been dissected. Apparently, the Klamath Mountains were lifted and warped upward toward the east. This uplift resulted in the erosion that has evolved the rugged landscape of today (*13*). The part of this geologic province in the survey area includes the dissected slopes east of the Trinity County boundary and extends northeasterly to Shasta Lake.

The Klamath Mountains include both metavolcanic and metasedimentary rocks and also intrusions of granitic rocks, serpentine, and basalt. The soils that formed in schist are characterized by the Stonyford series and those on greenstone by the Goulding, Neuns, and Stonyford series. Shale underlies the Maymen and Sheetiron soils. The Henneke soils formed in material weathered from serpentine rock. Granitic rocks underlie the Auberry, Chaix, Corbett, and Sierra soils.

The fertility of soils that formed on the metamorphosed formations of the Klamath Mountains varies widely, depending on the chemical nature of the rocks and on the content of weatherable minerals. In general, these metamorphosed rocks do not weather readily, and shallow soils are common. Soils from metamorphosed rocks characteristically are gravelly because strata of quartz, quartzite, and other siliceous rocks are not easily weathered and remain in the soil as gravel-size fragments. Soils that formed in metasedimentary rocks have low fertility, probably because the sediment in the rocks were weathered in one or more earlier erosion cycles. For example, the Marpa, Josephine, and Sites soils are less fertile than the Aiken and Cohasset soils that formed in andesitic rocks.

Narrow bands of serpentine, a strongly metamorphosed basic rock, are also within the survey area. The infertile Henneke soils formed in these deposits. The infertility of these soils is the result, in part, of the large amount of magnesium in relation to calcium in these soils. The high concentration of magnesium seriously reduces the uptake of calcium by plants (*3*).

Granitic rocks have weathered deeply, but the resultant soils are droughty and contain a large amount of coarse quartz grains. The soils are steep, and erosion is rapid, especially if the cover of plants is destroyed.

Coast Range.—The Coast Range formed during the same span of time as the Klamath Mountains. Only a small part of the Coast Range is in the survey area. This part is in the southwestern corner of the survey area and consists of about 140 square miles of shale and sandstone. Small scattered areas of these formations also are north and east of Redding.

Soils that are characteristic of these areas of shale and sandstone are the Lodo, Millsap, and Sehorn. The shale and sandstone underlying the Millsap and Sehorn soils weather more rapidly than those underlying Lodo soils. The Millsap and Sehorn soils are deeper and more fertile than Lodo soils. The Sehorn soils are more fertile because they have high base saturation, partly because of the underlying calcareous shale.

Great Valley of California.—The Great Valley basin at one time extended over most of the survey area now occupied by the Sacramento Valley and the Coast Range. At times this lowland was under water. The uplift of the Coast Range narrowed the basin and formed the present outline of the western margin of the valley. Continuing deposition and erosion cycles, caused by intermittent uplifts, produced a series of terraces along the valley margins.

The part of the Great Valley that is in the survey area consists of recent alluvial sediment along the Sacramento River and its tributaries and of a series of elevated alluvial terraces in a semicircle around the northern end of the Sacramento Valley (*13*). The soils that formed on these alluvial plains and terraces support nearly all of the cultivated crops grown in the survey area.

Soils that characteristically are on the older terraces are the Clough, Newtown (fig. 15), Igo, Red Bluff, and Redding. Tuscan soils are on slightly lower terraces. These soils are underlain by gravelly and stony sediment of various ages. The Inks, Pentz, and Toomes soils formed in tuffs and tuffaceous sediment.

A few areas of Clough, Red Bluff, and Redding soils are cultivated. All these soils are relatively infertile because the soils are dominated by kaolinitic clays and have a very low cation-exchange capacity. Figure 16 compares the cation-exchange capacity of the Red Bluff and Guenoc soils in the Shasta County Area. These soils formed under a similar climate, have a similar texture, and are similar in geologic age. Their mineralogy results, in part, from the mineral character of the underlying formations.

On younger intermediate terraces, the Hillgate, Moda, and Tehama soils formed in alluvium derived from various types of rocks. Keefers soils formed in alluvium derived mostly from basalts and andesites on terraces, and Spreckels soils formed in alluvium derived mostly from pumiceous tuffs.

The Moda and Tehama soils are less fertile than Keefers soils, probably because of the small amount of weatherable minerals in the parent material. The alluvium underlying these soils probably has passed through at least two previous erosion cycles. In contrast, the alluvium under Keefers soils probably has passed through only one erosion cycle.

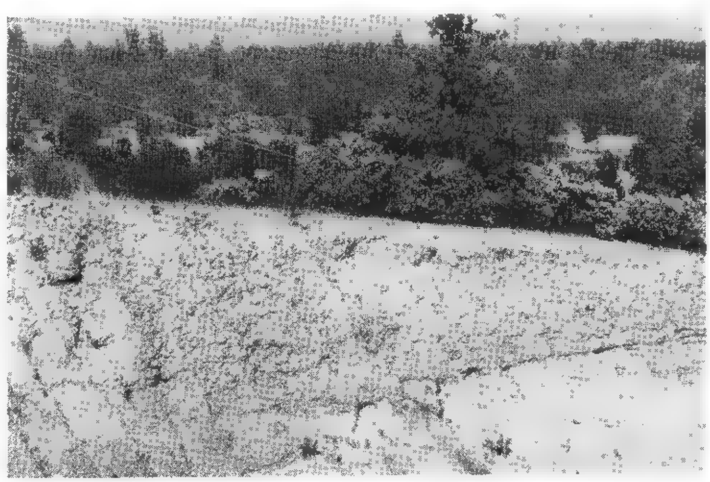

Figure 15.—Area of Newtown soils, showing bedding and stratification of the underlying Tehama formation.

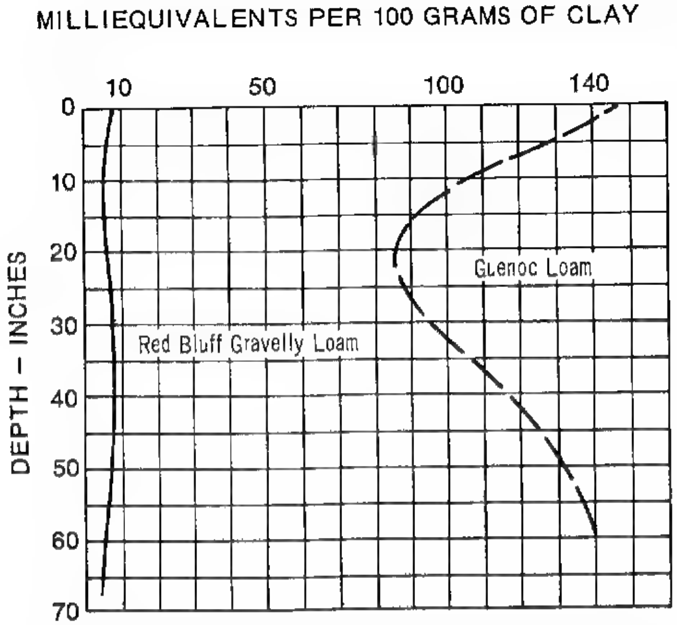

Figure 16.—**Cation-exchange capacity of Red Bluff and Guenoc soils in the Shasta County Area.**

On the lowest terraces the Churn and Perkins soils formed in alluvium derived from various sources, and Honn soils formed in alluvium derived in part from pumiceous tuffs.

Along the streams are slightly weathered recent alluvial deposits. The Anderson, Honcut, Molinos, Myers, Reiff, Tujunga, and Vina soils formed in these areas. Differences in properties of these soils result mostly from differences in mineralogy and texture of the geologic formations from which the alluvium was derived.

Climate

Climate has a marked influence on the formation of soils. Heat and moisture strongly influence the amount and kind of vegetation that grows, the rate at which organic matter decomposes, the rate at which minerals weather, and the removal of material from the different soil horizons or accumulation of material in them.

Temperature and precipitation in the survey area differ according to elevation, except for some local differences. In the south-central part of the survey area at an elevation of 500 feet, the annual precipitation is about 25 inches, and the average annual temperature is about 63° F. Generally, precipitation increases and temperature decreases regularly as elevation increases. At an elevation of 2,000 to 2,500 feet, annual precipitation is about 40 to 60 inches, and the average annual temperature is about 56° F. Precipitation is similar at elevations as high as 5,000 or 6,000 feet, and at these elevations the average annual temperature is 48° F. or less. Because of the cooler temperature, the seasonal snowfall is 50 to 100 inches.

The summers are dry and hot in the valley and warm and dry at higher elevations. About half the precipitation falls during December, January, and February and only 2 to 4 percent during July, August, and September. At low elevations, the average rainfall in summer is slightly less than 1 inch, and at higher elevations the rainfall in summer is about 2 inches. In summer the average daily soil temperature in the valleys and foothills exceeds 60° F. for 6 or 7 months, but at higher elevations the soil temperature rarely is higher than 60° F.

These combinations of moisture and temperature result in wide variations in rate of weathering by biological and chemical agents. The relationships of these extremes of weathering to soil formation are shown in figure 17, where the distribution of clay is shown for three soil profiles. The small amount of clay accumulation in Windy soils is near the surface because the soil temperature below a depth of about 20 inches is so cold that weathering proceeds at a very slow rate. Also, the upper 8 inches of the mineral soil dries out in summer and inhibits weathering in the uppermost mineral horizon. In addition, the large amount of water passing through the profile of Windy soils tends to remove colloids from the entire profile. In Supan soils the rate of weathering is very slow during most of the hot weather. Rainfall is less at lower elevations, and leaching of colloids tends to concentrate the clays at depths of 30 to 45 inches.

Between these extremes of cool, moist winters and hot, dry summers is the zone of maximum rate of weathering. In these intermediate areas, summers are warm, and the soils generally are moist. Chemical and biological weathering proceeds at a rapid rate for a longer period. The result is that more colloids are produced and a concentration of clays is in the lower part of the profile at a depth of 3 to 5 feet.

Other evidence of the effects of climate on soil formation is illustrated in figure 18, where Windy soils, which occur

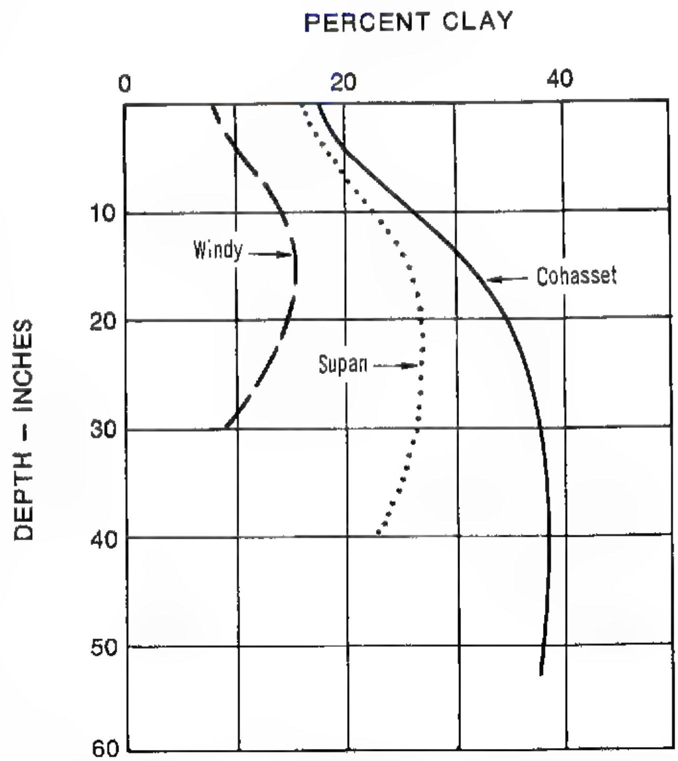

Figure 17.—**Distribution of clay in the profiles of Cohasset, Windy, and Supan soils.**

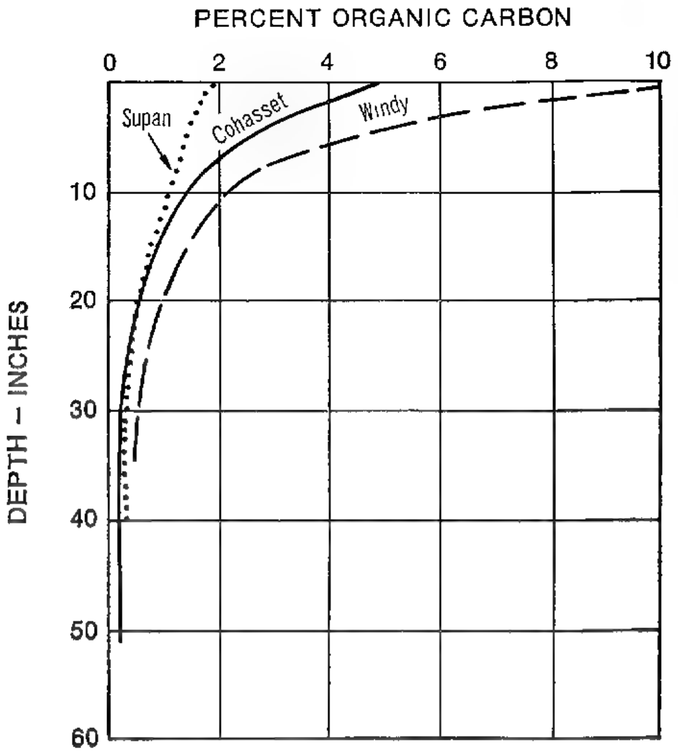

Figure 18.—**Percentage of organic carbon in soils of the Cohasset, Windy, and Supan series.**

at high elevations, are shown to have about four times as much organic carbon in the upper 5 inches as Cohasset soils and about six times as much as Supan soils. This illustrates the effects of temperature and moisture on the rate of decomposition of plant remains.

Differences in the rate of chemical weathering also are evident in the coloring and reaction of the B horizon of these three soils. The B horizon of Windy soils is light yellowish brown and very strongly acid; the B horizon of Cohasset soils is yellowish red and medium acid; and the B horizon of Supan soils is dark brown and neutral in reaction. Evidently, the greatest amount of oxidation of iron has taken place in Cohasset soils.

Biological activity

The vegetation in the survey area has had more effect on the formation of soils than other biological agents. Earthworms and burrowing rodents have stirred the soils to a minor degree, but this activity is unimportant compared to the effects of vegetation. The main effects of vegetation result from the accumulation of organic matter in the surface layer, and from penetration of roots into the surface layer, the subsoil, and the substratum. The accumulation of organic matter is small in the valley, where the period of favorable moisture and temperature is short. In this part of the survey area, the content of organic matter in the upper foot of the soils generally is about 1 percent. The more moist soils along streams, however, are darker than soils in other areas, and the content of organic matter is about 2 percent.

The content of organic matter generally increases as elevation increases because the climate is cooler and more moist. In the foothills, under a vegetation of grass, the content of organic matter in the upper foot of the soils is about 2 to 5 percent. At still higher elevations, under a vegetation of coniferous forest, the content of organic matter in the upper foot is 4 to 6 percent. At the highest elevations, the content of organic matter is 10 to 15 percent. Decomposition of the organic matter and metabolism of plants produce acids that increase the rate of weathering. Leaf litter or duff also insulates the soil against heat and cold and reduces the rate of evaporation, which increases the length of time favorable for bacterial activity.

Man has disturbed the soils in the survey area by clearing and cultivating soils, by harvesting timber, by grazing livestock, and by mining. Of these disturbances, placer mining has been more widespread. Nearly 9,000 acres of soil were overturned by gold dredges and placer miners. Also, fumes from a smelter destroyed the vegetation in a large area northwest of Redding, and this loss of vegetation resulted in severe erosion.

Time

The age of the soils in the survey area ranges from very young to very old. The oldest soils are nearly level and are on high terraces. The youngest soils formed in recent deposits of alluvium along streams and in areas exposed by recent erosion. Soils of intermediate age generally formed on terraces between old high terraces and recent alluvium.

The landscapes on which the oldest soils occur have features that result in very slow erosion. The strongly weathered soils are nearly level, hummocky, or gently undulating. Runoff is slow on these soils. These soils have a hardpan or a clay subsoil at a depth of less than 2 feet. They are very slowly permeable to slowly permeable to roots and water, acid in reaction, and low in fertility. These soils particularly lack nitrogen and phosphorous, and many have a very low cation-exchange capacity.

The soils that formed in recent deposits of alluvium generally are deep, permeable, and high in mineral plant nutrients. They are stratified and have no noticeable genetic horizons other than a dark-colored surface layer.

The soils that formed on terraces that are intermediate in elevation have an intermediate degree of weathering. In general, the higher the terrace level, the older, more strongly weathered, and less fertile the soil. On sides of terraces or on terrace escarpments, the soils generally are less weathered than the gently sloping soils on tops of terraces. Because of erosion, soil formation is slower on the steeper sides of terraces.

Little remains of the oldest surface layers except on narrow ridgetops. Erosion has been equal to soil formation, and all that remains of the ancient soils are remnant hardpans or claypans. Probably some of these ancient soils are now a substratum of the moderately deep phase of the soils of the Red Bluff series.

Examples of the soils that formed on old high terraces are soils of the Clough, Redding, and Tuscan series. Latter intermediate terraces have such soils as those of the Hillgate, Red Bluff, and Spreckels series. Soils on younger terraces include those of the Churn, Keefers, and Perkins series, and examples of soils that formed in recent alluvium are in the Anderson, Honcut, and Reiff series. In places the terrace soils are underlain by cemented gravel. This type of substratum is in some of the Keefers and Perkins soils.

The effect of time on the degree of weathering of soils underlain by bedrock is much more difficult to estimate. For example, soils that formed in explosion debris, such as Cone soils, show little evidence of horizons except for a dark-colored surface layer. Soils that formed in granitic rocks show very little evidence of soil formation or they show much evidence, depending on the kind of relief. Chaix soils are steep, and they have little horizonation other than a dark-colored surface layer; but Sierra soils are gently undulating, and they have a reddish-brown clay loam subsoil. Evidently, formation of the subsoil cannot be related to the age of the soils unless the soils formed under similar climatic conditions and in similar parent material and had a similar rate of erosion.

As soils become older and more strongly weathered, the soil-forming processes cause changes that are very important to farming. In well-drained soils, the changes produced by soil-forming processes include (1) the leaching of bases from the upper part of the soil and consequent increases in acidity; (2) the formation of clay and its accumulation in the subsoil; (3) an increase in the phosphate-fixing power of soils; and (4) the cementation of some subsoil layers to form hardpans. Because of such changes in the older soils of Shasta County Area, intensive farming is confined mostly to young soils on low terraces and flood plains. The older soils are used mostly for grazing, irrigated pasture, and dryfarmed crops.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and used in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*2*) and later revised (*12*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. It is under continual study (*8*, *9*, *16*). Therefore, readers interested in developments of the current system should search the latest literature available. The soil series of the Shasta County Area are placed in some categories of the current system in table 8. A detailed description of each soil series represented in the Shasta County Area is given under "Descriptions of the Soils." The classification shown in table 8 is that for each series as it is defined. The classification for taxadjuncts to soil series is given in footnotes 1 through 7.

ORDERS: Ten orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The soil properties used to differentiate the orders are those that tend to give broad climatic groupings of soils. The exceptions, Entisols and Histosols, are in many different climates. Six orders are represented in the survey area. They are Entisols, Vertisols, Inceptisols, Mollisols, Alfisols, and Ultisols.

TABLE 8.—*Classification of the soil series by higher categories*

Series	Family	Subgroup	Order
Aiken	Clayey, kaolinitic, mesic	Xeric Haplohumults	Ultisols.
Anderson	Loamy-skeletal, mixed, nonacid, thermic	Typic Xerofluvents	Entisols.
Anita	Fine, montmorillonitic, thermic	Typic Durochrepts	Inceptisols.
Auberry	Fine-loamy, mixed, thermic	Ultic Haploxeralfs	Alfisols.
Auburn	Loamy, mixed, thermic	Ruptic-Lithic-Xerochrepts	Inceptisols.
Behemotosh	Loamy-skeletal, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Boomer	Fine-loamy, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Chaix	Coarse-loamy, mixed, mesic	Dystric Xerochrepts	Inceptisols.
Churn	Fine-loamy, mixed, thermic	Ultic Haploxeralfs	Alfisols.
Clough	Clayey-skeletal, kaolinitic, thermic	Abruptic Durixeralfs	Alfisols.
Cohasset	Fine-loamy, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Cone	Medial-skeletal, mesic	Typic Vitrandepts	Inceptisols.
Corbett	Mixed, frigid	Typic Xeropsamments	Entisols.
Diamond Springs	Fine-loamy, mixed, mesic	Typic Haploxerults	Ultisols.
Forward	Medial, mesic	Typic Vitrandepts	Inceptisols.
Gaviota	Loamy, mixed, nonacid, thermic	Lithic Xerochrepts	Inceptisols.
Goulding [1]	Loamy-skeletal, mixed, mesic	Lithic Xerochrepts	Inceptisols.
Guenoc [2]	Fine, kaolinitic, thermic	Typic Rhodoxeralfs	Alfisols.
Henneke	Clayey-skeletal, serpentinitic, thermic	Lithic Argixerolls	Mollisols.
Hillgate	Fine, montmorillonitic, thermic	Typic Palexeralfs	Alfisols.
Holland	Fine-loamy, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Honcut	Coarse-loamy, mixed, nonacid, thermic	Typic Xerorthents	Entisols.
Honn	Fine-loamy, mixed, thermic	Mollic Haploxeralfs	Alfisols.
Igo	Fine-loamy, mixed, thermic	Typic Durixeralfs	Alfisols.
Inks	Loamy-skeletal, mixed, thermic	Lithic Argixerolls	Mollisols.
Jiggs	Medial, frigid	Typic Vitrandepts	Inceptisols.
Josephine	Fine-loamy, mixed, mesic	Typic Haploxerults	Ultisols.

See footnotes at end of table.

TABLE 8. *Classification of the soil series by higher categories*—Continued

Series	Family	Subgroup	Order
Kanaka	Coarse-loamy, mixed, thermic	Dystric Xerochrepts	Inceptisols.
Keefers	Clayey-skeletal, montmorillonitic, thermic	Mollic Haploxeralfs	Alfisols.
Kidd	Medial, mesic	Lithic Vitrandepts	Inceptisols.
Kilarc	Clayey, montmorillonitic, mesic	Typic Haploxerults	Ultisols.
Lodo	Loamy, mixed, thermic	Lithic Haploxerolls	Mollisols.
Los Robles	Fine-loamy, mixed, thermic	Mollic Haploxeralfs	Alfisols.
Lyonsville	Fine-loamy, mixed, frigid	Typic Haploxerults	Ultisols.
Marpa	Loamy-skeletal, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Maymen	Loamy, mixed, mesic	Dystric Lithic Xerochrepts	Inceptisols.
McCarthy	Medial-skeletal, mesic	Typic Vitrandepts	Inceptisols.
Millsap	Fine, vermiculitic, thermic	Typic Palexeralfs	Alfisols.
Millsholm	Loamy, mixed, thermic	Lithic Xerochrepts	Inceptisols.
Moda	Fine, vermiculitic, thermic	Abruptic Durixeralfs	Alfisols.
Molinos	Coarse-loamy, mixed, thermic	Pachic Haploxerolls	Mollisols.
Myers	Fine, montmorillonitic, thermic	Entic Chromoxererts	Vertisols.
Nanny	Loamy-skeletal, mixed, frigid	Typic Xerumbrepts	Inceptisols.
Neuns	Loamy-skeletal, mixed, mesic	Dystric Xerochrepts	Inceptisols.
Newtown	Fine, montmorillonitic, thermic	Ultic Haploxeralfs	Alfisols.
Parrish	Fine, vermiculitic, mesic	Ultic Haploxeralfs	Alfisols.
Pentz	Medial, thermic, shallow	Typic Vitrandepts	Inceptisols.
Perkins	Fine-loamy, mixed, thermic	Mollic Haploxeralfs	Alfisols..
Red Bluff [3]	Fine, kaolinitic, thermic	Ultic Palexeralfs	Alfisols.
Redding	Fine, kaolinitic, thermic	Abruptic Durixeralfs	Alfisols.
Reiff [4]	Coarse-loamy, mixed, nonacid thermic	Typic Xerorthents	Entisols.
Sehorn	Fine, montmorillonitic, thermic	Entic Chromoxererts	Vertisols.
Sheetiron [5]	Loamy-skeletal, micaceous, mesic	Dystric Xerochrepts	Inceptisols.
Shingletown	Fine-loamy, mixed, mesic	Aquic Argixerolls	Mollisols.
Sierra	Fine-loamy, mixed, thermic	Ultic Haploxeralfs	Alfisols.
Sites	Clayey, kaolinitic, mesic	Xeric Haplohumults	Ultisols.
Spreckels [6]	Fine, mixed, thermic	Ultic Palexeralfs	Alfisols.
Stonyford	Loamy, mixed, thermic	Ruptic-Lithic Mollic Haploxeralfs	Alfisols.
Supan	Fine-loamy, mixed, mesic	Pachic Argixerolls	Mollisols.
Tehama	Fine-silty, mixed thermic	Typic Haploxeralfs	Alfisols.
Toomes	Loamy, mixed, thermic	Lithic Xerochrepts	Inceptisols.
Tujunga [7]	Mixed, thermic	Typic Xeropsamments	Entisols.
Tuscan	Fine, montmorillonitic, thermic	Typic Durixeralfs	Alfisols.
Vina	Fine-loamy, mixed, thermic	Fluventic Haploxerolls	Mollisols.
Windy	Cindery, frigid	Typic Dystrandepts	Inceptisols.

[1] The Goulding soils in the Shasta County Area are taxadjuncts to the Goulding series because they contain fewer coarse fragments than is currently defined for the series. They are classified in the survey area as loamy, mixed, nonacid, mesic Lithic Xerorthents.

[2] The Guenoc soils in the Shasta County Area are taxadjuncts to the Guenoc series because they contain more coarse fragments than is currently defined for the series. They are classified in the survey area as clayey-skeletal, kaolinitic, thermic Typic Rhodoxeralfs.

[3] The Red Bluff soils in mapping units RcA, RcB, ReA, and ReB are taxadjuncts to the Red Bluff series because they are shallower to a duripan than is currently defined for the series. These soils are classified in the survey area as fine, kaolinitic, thermic Typic Durixeralfs.

[4] The Reiff soils in the Shasta County Area are taxadjuncts to the Reiff series because they have darker colors, more developed structure, and weaker consistence, when dry, than is currently defined for the series. They are classified in the survey area as coarse-loamy, mixed, thermic Entic Haploxerolls.

[5] The Sheetiron soils in the Shasta County Area are taxadjuncts to the Sheetiron series because they contain more coarse fragments than is currently defined for the series. They are classified in the survey area as loamy-skeletal, mixed, mesic Dystric Xerochrepts.

[6] The Spreckels soils in the Shasta County Area are taxadjuncts to the Spreckels series because they are underlain by a duripan. They are classified in the survey area as fine, mixed, ther mic Typic Durixeralfs.

[7] The Tujunga soils in the Shasta County Area are taxadjuncts to the Tujunga series because they contain more coarse framgents than is currently defined for the series. They are classified in the survey area as sandy-skeletal, mixed, thermic Typic Xerorthents.

Entisols are young mineral soils that do not have genetic horizons or have only the beginning of such horizons. They generally are very young or recent soils.

Vertisols are mineral soils that are high at 2:1 lattice clays and that lack diagnostic horizons in places. They shrink and form large cracks when dry and swell when wet.

Inceptisols are mineral soils that have started to form genetic horizons. They do not represent significant illuviation or eluvation or extreme weathering. They are most often on young, but not recent, land surfaces.

Mollisols are mineral soils that have a thick dark-colored surface layer that contains more than 1 percent organic matter and that has a base saturation of more than 50 percent. They mostly formed under grass.

Alfisols are mineral soils that have a light-colored or thin dark-colored surface layer and an accumulation of illuvial clay in the subsoil. The subsoil has a base saturation of more than 35 percent.

Ultisols are mineral soils that have a subsoil of illuviated clay and a base saturation of less than 35 percent.

SUBORDERS: Each order is subdivided into suborders, primarily on the basis of soil characteristics that seem to produce classes that have the greatest genetic similarity. The suborders have a narrower climatic range than the

orders. The criteria for suborders chiefly reflect the presence or absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUPS: Each suborder is divided into great groups according to the presence or absence of genetic horizons and the arrangement of these horizons.

SUBGROUPS: Each great group is divided into subgroups. One of these subgroups represents the central (typic) segments of the great group; and the others, called intergrades, contain those soils having properties of soils in another group, subgroup, or order.

FAMILIES: Each subgroup is divided into families, primarily on the basis of properties important to the growth of plants. Among the properties considered are texture, mineralogy, reaction, soil temperature, and thickness of horizons.

SERIES: The series consists of a group of soils that are essentially uniform in differentiating characteristics and in arrangement of horizons, or if genetic horizons are thin or absent, a group of soils that, within defined depth limits, are uniform in all properties diagnostic for the series. These diagnostic properties include color, texture, structure, consistence, reaction, and mineralogical and chemical composition.

Laboratory Analyses [7]

The results of the physical and chemical analyses of representative soils of the survey area are given in table 9. The soil samples were screened through a 2-millimeter round-holed sieve. The aggregates were crushed with a rubber-tipped pestle. After being rubbed relatively clean, the gravel and stones larger than 2 millimeters in diameter were weighed to determine the percentage of gravel and were then discarded. The material that passed through the sieve was thoroughly mixed, and aliquot parts were used for the laboratory analyses. Methods of analyses used to obtain the data given in table 9 are described in the paragraphs that follow.

Methods of analyses

Sand, silt, and clay.—The percentage of sand was determined through the use of 10 grams of oven-dried soil to which water and calgon, a sodium hexametaphosphate, had been added. This mixture was shaken overnight in a reciprocating shaker. The soil was then wet sieved through a 300-mesh screen, transferred to an evaporating dish, oven

[7] E. P. PERRY, specialist in soils, California Experiment Station and State Cooperative Soil Vegetation Survey.

TABLE 9.—*Laboratory*

[Analyses by Soil Survey Laboratory, University of California, Berkeley, California.

Soil	Depth from surface	Size, class, and diameter of particles						
		Very coarse sand (2–1.0 mm.)	Coarse sand (1.0–0.5 mm.)	Medium sand (0.5–0.25 mm.)	Fine sand (0.25–0.1 mm.)	Very fine sand (0.1–0.05 mm.)	Silt (0.05–0.002 mm.)	Clay (<0.002 mm.)
	In.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Aiken loam	0–1	6.4	11.3	7.1	9.0	6.9	34	25
	1–10	4.7	8.3	6.4	9.5	7.5	31	33
	10–24	3.2	6.8	5.1	8.7	8.9	31	36
	24–48	.5	1.4	1.5	4.4	5.7	35	51
	48–66	.2	.4	.8	3.1	5.5	37	53
	66–80	.2	.7	1.7	5.8	8.8	35	48
Behomotosh loam	0–2	14.1	11.7	6.3	9.0	10.2	37	12
	2–4	10.1	11.6	6.4	9.7	11.0	39	12
	4–16	6.2	10.4	7.1	10.7	11.3	38	16
	16–20	6.5	8.4	5.6	8.5	7.9	35	28
Jiggs sandy loam	0–2	12.3	15.8	11.1	12.9	6.8	23	18
	2–12	10.8	17.5	11.0	10.9	7.5	25	19
	12–23	9.5	15.1	11.8	13.3	7.4	27	16
Kilaro very stony sandy clay loam.	0–9	7.6	9.4	9.7	18.4	11.8	24	19
	9–16	1.6	2.3	2.7	5.8	4.7	19	64
	16–22	2.8	3.8	4.0	7.2	6.8	24	51
	22–34	1.5	2.4	3.9	15.5	10.3	25	41
	34–44	2.3	7.3	6.8	8.9	7.5	26	41
Marpa gravelly loam.	0–6	10.4	10.3	5.5	7.1	7.2	32	27
	6–13	5.7	10.0	6.1	7.9	7.9	34	28
	13–26	7.1	9.4	4.6	6.7	7.2	31	34

dried, and weighed. The total sand was expressed in percentage of the weight of the original oven-dried sample. The dried sand was then fractionated through a nest of sieves in a mechanical shaker, and each fraction was weighed.

The percentage of clay, particles less than 2 microns in diameter, was determined by the hydrometer method. Fifty grams of soil, together with calgon as a dispensing agent, were shaken overnight in a reciprocating shaker and then transferred to a 1,000-centimeter cylinder. Hydrometer readings were taken at the proper intervals to record the amount of clay remaining in suspension. The results were expressed in percent of the oven-dried soil.

The percentage of silt was determined by adding the percentage of sand and the percentage of clay and then subtracting the total from 100 percent.

Moisture equivalent.—The moisture equivalent represents approximately the normal field capacity, or the amount of water that is held in a soil after a heavy rain or an irrigation, where drainage downward is free and uninterrupted.

The moisture equivalent was determined by the standard method in which 30 grams of saturated soil was subjected to a force of 1,000 gravity in a centrifuge. The results were reported as the percentage of moisture retained, calculated on an oven-dry soil. A few soil samples were too compact to allow free passage of water, and water was retained on the surface of the soil after the centrifuge run. When this occurred, the procedure was repeated with another sample; waxed paper liners were used in the centrifuge cups to facilitate drainage.

Permanent wilting point.—Permanent wilting point is the moisture content of a soil, at which plants wilt and fail to recover their turgidity. The percentage of water remaining in the soil at this time is called the permanent wilting point, or percentage. This point was determined by growing dwarf sunflowers, then withholding water, and then measuring the amount of water remaining in the soil when the flowers became permanently wilted.

Pressure membrane studies.—Another method of measuring the force with which soil is able to hold water is that of subjecting a saturated soil to different pressures and determining the amount of water the soil is able to retain. The soil samples were put into small rings on a membrane placed over a porous plate, were saturated with water, and were then placed in the pressure plate apparatus. The desired pressure was obtained with nitrogen gas. Some samples were held for 48 hours under one-third atmosphere

analyses of soils

< means less than. Absence of an entry indicates that no determination was made]

Bulk density	Moisture held at tension of—		Moisture equivalent	Atmos	Organic carbon	Total nitrogen	Carbon nitrogen ratio	Reaction	Water-soluble phosphate
	1/3 atmosphere	15 atmospheres							
G. per cc.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*		*pH*	*P.p.m.*
----------	41.1	23.6	38.4	18	6.12	0.295	21	6.6	0.10
1.1	31.7	20.8	30.8	11	2.31	.115	20	6.0	.05
1.3	29.0	20.7	28.3	8	1.43	.065	22	5.7	.05
1.6	37.6	26.6	34.0	11	.62	.029	21	6.0	<.03
1.4	38.3	29.0	36.7	9	.44	.020	22	5.6	<.03
----------	40.1	28.8	37.6	11	.26	.005	----------	6.1	<.03
----------	30.1	9.5	26.2	21	4.84	.113	36	5.8	.14
----------	28.3	8.5	25.1	20	3.84	.099	39	5.8	.07
----------	25.7	7.3	22.0	18	1.60	.044	36	5.4	<.03
----------	29.6	11.9	25.5	18	.68	.025	27	5.6	<.03
----------	25.3	8.3	22.6	17	1.72	.895	45	5.1	.02
----------	25.0	9.6	21.8	15	1.75	.038	28	4.7	.04
----------	23.8	9.8	21.3	14	.88	.034	26	4.9	.04
1.6	21.6	9.3	18.6	12	1.29	.094	14	6.2	.16
1.9	41.0	24.0	44.2	17	.56	.034	16	4.2	.03
1.6	40.0	24.7	37.8	15	.56	.029	19	4.2	.04
1.8	24.8	14.6	23.6	10	.21	.007	----------	4.4	.08
1.9	25.9	15.0	24.1	11	.15	.005	----------	4.5	2.90
----------	33.5	14.2	29.7	19	3.17	.173	18	6.1	.18
1.2	31.1	13.8	28.3	17	2.18	.141	15	6.1	.07
----------	29.8	15.0	27.0	15	.91	.089	10	5.4	.04

pressure; others were held for 24 hours under 15 atmospheres pressure. The amount of moisture retained was then determined. The amount of moisture retained at one-third atmosphere pressure corresponds fairly closely with the moisture equivalent determination, and that retained at 15 atmospheres pressure, to the permanent wilting point.

Reaction.—The Beckman glass-electrode pH meter was used for the determination of the reaction of each soil. Approximately 50 grams of soil were saturated with distilled water and allowed to stand for 1 hour before the reading was made. A pH value of 7.0 designates a neutral soil. Values decreasing from 7.0 designate an increasingly acid soil; those increasing from 7.0 designate an increasingly alkaline soil.

Bulk density.—The bulk density was determined by the zinc chloride method. A representative lump of air-dried soil was given a thin coating of paraffin and then dropped into successive solutions of zinc chloride made up to standard true densities. The lowest density solution in which the lump floats gives the bulk density of the lump of soil.

Water-soluble phosphate.—The amount of water-soluble phosphate was determined by the modified Bingham method. The soil was extracted with water, and an aliquot of this water extract was tested. Phosphate ion in an acidic solution forms a relatively water-stable complex with a molybdate ion, which, in the presence of stannous chloride, turns blue. The intensity of the blue color is a measure of the amount of phosphate present in the aliquot sample.

Total nitrogen.—Total nitrogen was determined by the Kjeldahl method. A weighed sample of soil was digested by boiling it in sulfuric acid in the presence of a mixture of copper sulfate, ferrous sulfate, and potassium sulfate. This converted the organic nitrogen to the ammonia form. After the addition of concentrated sodium hydroxide, the ammonia was driven off by steam distillation, collected in a 3-percent boric acid solution, and then titrated with hydrochloric acid. An indicator made by mixing methyl red and bromcresol green was used.

Carbon and organic matter.—Total carbon was determined by the dry combustion method. A weighed sample of soil was placed in a muffle and ignited at 900° C. in an oxygen stream. Any compound containing carbon was thus oxidized, and the carbon was released as carbon dioxide, which was then absorbed. The increased weight of the absorbent, ascarite, is a direct measure of the carbon dioxide produced. The weight of carbon is converted to the weight of organic matter by multiplying by the factor 1.724.

General Nature of the Area

This section discusses the development of the Shasta County Area; describes the physiography, relief, and drainage; and gives facts about the climate, water supplies, community facilities and recreation, and farming.

Shasta County is named after Mount Shasta, a volcanic peak 14,162 feet high that looms on the skyline throughout much of the northern part of California. Some say that Russian traders who saw the peak from the Coast Range called it Shasta, their native word for white, chaste, or pure. Others attribute the name to a tribal group who lived at the foot of the mountain.

The earliest settler in the area was Pierson B. Reading, who in 1845 received from the Mexican Government a land grant of 36,633 acres, which was along the west bank of the Sacramento River. Within the boundaries of this land grant was some of the best soil for farming in the survey area. Today, more than half of the urban and suburban developments are on land originally included in that tract. The rest of the acreage, except for a small mountainous area north and west of Redding, was divided into townships and sections and was sold to private citizens. The small mountainous tract was never surveyed, and it has remained under the administration of the Bureau of Land Management.

Gold was discovered in the area in 1848, and soon the gold rush was on in Shasta County. After the first placer diggings along streams were depleted, hard rock mining began. Mining remained the major industry in the county until after World War I. In addition to gold, large amounts of copper, silver, and iron ore were produced.

After the discovery of gold, the second major development was the arrival of the railroad in 1872. At that time, the Central Pacific Railroad tracks reached Shasta County from the south.

Between 1910 and 1920, mining activities sharply declined. One reason for the decline was the severe damage to crops and other vegetation caused by fumes from the smelters. This damage resulted in numerous lawsuits, some of which were successful. The fumes completely destroyed the vegetation on 16,000 acres. Since the vegetation was destroyed, the soils in that area have been highly susceptible to erosion (fig. 19).

A third important development in Shasta County was the beginning of construction of the Shasta Dam and the Shasta Reservoir in 1938. The dam, which is among the largest and highest concrete structures in the world, is 12 miles north of Redding. The Shasta Reservoir extends for 35 miles up the canyons of the Sacramento, Pit, and McCloud Rivers, and it contains 4.5 million acre-feet of water. The Shasta Dam has been important in providing additional irrigation water, controlling flooding, and producing hydroelectric power.

Partly as a result of the construction of the dam, the population of Shasta County has increased rapidly in recent years. According to records of the U.S. Bureau of the Census, the county had a population of 59,468 in 1960 and a population of 74,700 in 1965. About 90 percent of the people reside in this survey area. In 1965 Redding, the largest city, had a population of 15,400, Anderson 5,800, Cottonwood 2,500, and Central Valley 8,000. In addition, many people live in suburban areas that surround these population centers. Redding is the largest shopping center in the northern part of the Sacramento Valley. It serves all of Shasta County and parts of adjacent counties.

Physiography, Relief, and Drainage

The central and lowest part of the survey area consists of the narrow strip of nearly level soils that formed in alluvium along the Sacramento River south of Redding. This tract is 18 miles long and 2 to 3 miles wide, and it ranges from about 350 to 520 feet in elevation. It is sometimes referred to as Anderson Valley. This part of the Sacramento Valley is separated from the main part by an

Figure 19.—**Area of Diamond Springs very rocky sandy loam, 30 to 50 percent slopes, severely eroded, near Keswick. About 1910 the vegetation on this soil was completely destroyed by fumes from smelters.**

area 15 miles long of rolling soils on low hills in the northern part of Tehama County. It is through these hills that the Sacramento River has cut Iron Canyon 200 feet deep in places.

Surrounding this narrow central part on the east, west, and north is an irregular semicircle of older alluvial terrace deposits ranging in elevation from 500 to 1,000 feet and from 1 to 20 miles wide. The nearly level soils on the terrace tops have been completely removed by erosion in some places, leaving a rolling or hilly landscape with many small intermittent streams. Millville Plains, Swede Creek Plains, Stillwater Plains, and Happy Valley are areas where large tracts of the nearly level soils on old terrace tops remain. This semicircle of terrace deposits is also crossed by the wider drainageways of the larger tributary streams, such as Cottonwood Creek, Cow Creek, Churn Creek, and Stillwater Creek, which have alluvial flood plains that are 1 mile wide in many places.

Soils of the Coast Range, in the southwestern part of the survey area, are rolling to steep where they occur on rounded ridgetops and are gently sloping in the valleys. Soils of the Klamath Mountains generally are very steep and are in narrow valleys and on narrow ridgetops. The Cascade Range to the east is less steep and contains many gently sloping soils in small basins and steep soils on the sides of valleys. Large areas of nearly level and gently sloping soils are on broad ridgetops and plateaus.

The southward-flowing Sacramento River drains all the survey area, as well as a much larger part of the State to the north and northeast. The principal tributaries in the west are Cottonwood Creek, which drains about 371 square miles in Shasta County and 574 square miles in Tehama County, and Clear Creek, which drains about 245 square miles. In the north, Churn Creek and Stillwater Creek are intermittent streams that together drain 120 square miles. In the east, Cow Creek and its tributaries drain about 426 square miles, and Battle Creek drains 184 square miles in the survey area and 180 square miles in Tehama County. Also, Ash Creek and Bear Creek are smaller, intermittent streams that together drain about 150 square miles.

Climate [3]

This section discusses the climate in all of Shasta County, including the eastern plateau, which is outside the soil survey area.

Temperature and growing season.—The average annual temperature is about 63° F. in the Sacramento Valley, 45 to 50° in the eastern plateau area, and 50 to 60° in most of the rest of the area. The Area has warm temperatures in summer. The average maximum temperature in July is near 100° in the Sacramento Valley and in the 80's in the eastern plateau. Maximum temperatures have reached 105° or higher in most of the Area, and a record 119° has been recorded in Shasta. Temperatures at night are comfortably cool most of the time. Minimum temperatures in July average in the middle 60's in the Sacramento Valley and in the middle 40's in the eastern plateau. Temperature and precipitation data for the Shasta County Area are shown in table 10.

Temperatures in winter are fairly cool. The average minimum temperature in January is in the middle 30's in the Sacramento Valley, but it is around 18° F. in the colder areas on the plateau. Extreme low temperature readings are near 20° in the Sacramento Valley and as low as —20° in parts of the plateau area, but such extreme cold is exceptional. Average maximum temperatures in January are in the 50's in the Sacramento Valley and in the high 30's and the 40's in the plateau area.

The average date of the last 32° F. freeze in spring is mid-June for some of the plateau area, but it is as early as the latter part of February in the Sacramento Valley. The first 32° freeze in fall averages as early as the middle of September in the colder areas of the plateau, but it is in December in the Sacramento Valley. The growing season, based on 32° temperature, is only about 90 days in the east and as much as 250 to 300 days in the Sacramento Valley.

Precipitation.—Annual precipitation within the Shasta County Area ranges from about 25 inches in the Sacramento Valley to about 75 inches in the vicinity of Big Bend. Precipitation is probably greater at higher elevations.

Most of the precipitation falls in winter. From 75 to 90 percent of the annual total precipitation is received between November 1 and April 30. Thundershowers in summer occur on about 5 to 10 days a year, particularly in the mountains, but they account for only a small percentage of the total annual supply of moisture.

[3] This section was prepared by C. ROBERT ELFORD, State climatologist for California, and MAX R. MCDONOUGH, assistant State climatologist, National Weather Service, U.S. Department of Commerce.

TABLE 10.—*Temperature and precipitation for the Shasta County Area*

Month	Means and extremes of temperature at—										Average precipitation at—	
	Redding Fire Station No. 2					Volta Powerhouse					Pit River Powerhouse No. 5	Redding Fire Station No. 2
	Highest	Mean maximum	Mean temperature	Mean minimum	Lowest	Highest	Mean maximum	Mean temperature	Mean minimum	Lowest		
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	In.	In.
January	78	53. 9	45. 7	37. 5	17	76	53. 1	43. 6	34. 0	14	13. 99	7. 69
February	83	58. 1	49. 4	40. 7	24	79	56. 4	46. 3	36. 1	13	12. 50	6. 19
March	89	64. 4	54. 0	43. 6	27	85	58. 9	48. 3	37. 6	20	9. 60	4. 90
April	98	72. 0	60. 4	48. 8	30	92	69. 0	56. 4	43. 7	26	4. 82	2. 95
May	105	80. 0	67. 3	54. 5	31	99	76. 1	61. 8	48. 5	32	3. 53	1. 74
June	112	88. 7	75. 1	61. 4	38	105	89. 0	73. 7	58. 4	35	1. 51	1. 13
July	113	97. 5	82. 5	67. 9	49	110	94. 1	77. 8	61. 5	48	. 20	. 11
August	112	95. 7	80. 5	65. 3	48	107	92. 0	75. 6	59. 1	38	. 37	. 13
September	114	90. 3	75. 6	60. 9	39	108	87. 6	72. 2	56. 7	38	1. 57	. 61
October	105	77. 8	65. 4	53. 0	29	96	76. 0	62. 1	49. 2	30	5. 89	2. 27
November	95	65. 1	54. 8	44. 4	26	89	62. 6	51. 4	40. 2	25	9. 12	3. 76
December	82	55. 9	47. 5	39. 1	18	77	55. 8	46. 1	36. 3	14	12. 50	7. 26
Year	114	75. 0	63. 2	51. 4	17	110	72. 4	59. 6	46. 8	13	75. 60	38. 74

Rainfall intensities are greatest in the mountains. Short-period precipitation totals are likely to be greatest during thundershowers in fall or in spring, and the long-period totals reach a maximum during winter storms. Thunderstorms generally are limited to 3 to 5 days a year at low elevations, but they occur as frequently as 10 to 12 days a year in the mountains in places.

Snowfall.—Snowfall is very light at low elevations, and only a few inches are recorded in an average year. The annual total exceeds 100 inches in some of the mountain areas of the eastern plateau. Lower elevations on the plateau generally receive 30 to 40 inches of snowfall a year. Most areas above about 6,000 feet are covered by snow throughout the winter.

Evapotranspiration.—Evapotranspiration refers to the total transfer of moisture from the soil to the air in a field growing a well-established crop. Some of the water loss is by evaporation from the surface of the soil, while other moisture is carried upward and evaporated from the leaves and other plant surfaces. Relationships have been established between temperature and evapotranspiration, taking into account the latitude and time of year (*11*). These computed values of evapotranspiration are only approximate, but they provide an estimate of the water use by a growing crop. Values for water use provide a means of comparing the climate-related crop-production potential of specified areas, because the amount of dry matter in a plant is directly related to the amount of moisture that has moved through the plant.

Evaporation.—On the basis of limited evaporation records, the annual loss from a standard 4-foot evaporation pan is about 70 inches in the Sacramento Valley and 55 inches at the upper end of Shasta Lake. On the plateau, 63 inches appears to be typical. About 75 percent evaporates from May through October.

Evaporation from lakes and reservoirs is probably somewhat less than this. It is in the range of 45 to 55 inches a year for the Shasta County Area.

Wind.—Windspeed generally is slow, except during thunderstorms that produce locally strong winds and during winter storms. At Redding the windspeed is 8 miles per hour or less 50 percent of the time and 13 miles per hour or less 90 percent of the time. Winds of 32 miles per hour or more occur only 0.1 percent of the time.

Water Supply

Precipitation varies greatly from one part of the survey area to another. Much of the precipitation falls in winter, and peak runoff occurs in winter and spring. Little rain falls in summer, but many of the streams that drain mountain areas maintain a small flow throughout the summer. As these streams reach lower elevations, most are diverted, and the water is used for irrigation.

Shasta Dam and Shasta Reservoir on the Sacramento River just north of the survey area have eliminated the danger of flooding on most of the Sacramento River flood plain. These dams have also assured an adequate minimum flow of water for irrigation in summer.

Irrigation water is provided by one private and three public water service agencies, and domestic water is provided by 10 public and private water service agencies. A small acreage is irrigated from wells, and many ranchers who own acreages along the smaller streams have their own water diversion systems. Ground water supplies are adequate for domestic purposes, except in the area between Redding and Bella Vista, where the ground water tends to be salty. About 325 small reservoirs have been built to supply water for irrigation, livestock, and recreation. Technical assistance in building many of these reservoirs was provided by the Soil Conservation Service.

In 1955 a total of 33,780 acres was irrigated, and more than half of this acreage was in the Anderson-Cottonwood Irrigation District. The California Department of Water Resources estimates the ultimate potential irrigatable lands in the survey area as 143,200 acres.

Industry and Transportation

The processing of lumber and other wood products is a major industry in Shasta County. In 1963 the equivalent of 450 million board feet of timber was processed in this county. About 27 percent of the county, all outside the survey area, is administered by the U.S. Forest Service. The best nonfederally owned timberland is mostly in a few large holdings.

Farm products and mineral products are other major sources of income. Hydroelectric power, which is largely produced at points just outside the boundaries of the survey area, is also important. The 17 hydroelectric plants have a rated capacity of 1,448,300 kilowatts. Other major sources of employment are the wholesale and retail trades; service professions and occupations; government installations; manufacturing; contract construction; and transportation, communications, and utilities.

Transportation facilities are good. The main railroads have lines that pass through the survey area and extend to Oregon and Washington. Interstate Highway No. 5 also passes through the survey area. Westbound traffic moves on State Highway No. 299 to Weaverville and Eureka and on a paved county road to Platina. Eastbound traffic moves on State Highway No. 299 to Burney, Fall River Mills, and Alturas, and on State Highway No. 44 to Lassen Park. All these roads pass through Redding. About 1,900 miles of national and state roads and 1,200 miles of county roads are in the county. In the wooded areas there are many miles of private logging roads.

Buses make several scheduled runs north and south daily through the survey area and one run daily to Alturas and Eureka. The Redding City Airport is a trunkline airport and has a 6,000-foot main runway. It is equipped for instrument landings. One airline maintains a schedule of daily flights. Five other airports or landing strips are in the survey area.

Community Facilities and Recreation

Health facilities in the survey area include three general hospitals and a mental health clinic. Educational facilities include Shasta College, which has a 2-year curriculum. A modern combined civic auditorium and convention center was recently completed, and the area has a community symphony orchestra, a light opera association, two art galleries, and two museums.

Because of its accessibility; its wide range in climate, elevation, and topography; and its numerous lakes and streams, Shasta County is a unique recreational area. The Shasta State Historical Monument and Whiskeytown Lake Recreation Area are within the survey area and are a few miles west of Redding. Approximately 670,000 acres, or about one-fourth of the county, is in the Shasta and Lassen National Forests. The areas adjoin the survey area to the north and east. Areas of special interest within the National Forest area are Lassen Volcanic National Park, Shasta Lake Recreational Area, Castle Crags State Park, Latour State Forest Reserve, McArthur-Burney Falls Memorial State Park, and Thousand Lakes Valley Wild Area. There are also many privately owned recreational facilities of various kinds that are open to the public.

Farming

According to records of the U.S. Bureau of the Census, 800 farms and ranches were in Shasta County in 1959. The average size of these farms and ranches was 685 acres. Of the farms, however, 350 were commercial farms, which had an average size of 1,991 acres. Most of them are in Fall River Valley, which is outside the survey area. The larger farms and ranches are in the foothills of the mountain ranges, and the smaller ones are concentrated along the larger streams and on the flood plains of the Sacramento River.

Farming began in Shasta County Area when the first settlers arrived. By 1858 almost 6,500 acres were cultivated in Shasta County (*6*). The raising of cattle had become an important source of income by 1858, as had the breeding of hogs, sheep, and horses. Wheat and barley were the major field crops; and peaches, apples, and quinces were the major fruits produced. The importance of farming was overshadowed by the gold rush and by subsequent mining activities. It was later overshadowed by lumbering and construction. Farming has continued to have a stabilizing influence on the economy, however, even though only a fairly small acreage of soils is suitable for cultivation and the cost and availability of water for irrigation have always been a problem. The creation of the Anderson-Cottonwood Irrigation District in 1927 brought water to part of the survey area.

Before the arrival of the first railroad in 1872, much of the farm produce was consumed by local miners. Wheat was ground into flour at a mill in Millville. By 1900, fruit from dryfarmed trees, mainly peaches, plums, prunes, and pears produced mostly in the area near Anderson, had become an important source of income. Olives, figs, almonds, walnuts, and apples were also produced. Between 1910 and 1930, a series of disastrous freezes and competition from lower quality, but higher yielding, irrigated orchards to the south gradually eliminated the orchards of peach, plum, and pear trees in the Shasta County Area. Now, livestock, principally beef cattle, and livestock products account for more than half of the total income derived from the sale of farm products. Field crops, nursery stock, vegetable crops, fruit trees, and apiary products, in that order, account for most of the rest.

Olives are still grown extensively in Happy Valley, but development of the orchards is limited by industrywide low prices. Strawberries have long been an important crop in the survey area. Strawberry plants, shipped to areas farther south, are an important specialty crop. The production of apiary products has been important in the survey area for many years. Since World War II dairy farming has declined. Only a small number of herds and one processing plant are in the survey area.

Irrigated pasture and dryland pasture are important in the survey area, and they provide a large amount of forage for beef and dairy cattle. About 21,000 acres were in irrigated pasture in 1967. This acreage is mainly in the Anderson-Cottonwood Irrigation District, but some irrigated pasture is also in narrow valleys in other parts of the survey area where water is available for irrigation.

Dryland pasture provides excellent ground cover for stabilizing the soils, and the supply of forage is much greater than that of unimproved annual range. Dryland pasture occupied about 380,000 acres in the survey area in

1967. In some places large areas have been seeded to perennial grasses and annual plants. Annual plants grow well in the survey area because of the moist winters and hot, dry summers. They germinate late in fall and in winter when the amount of rainfall is greatest, are green in winter and early in spring, and dry up and go to seed late in spring. In most years green feed is provided on rangeland in the foothills from November through May. If the annual plants are allowed to go to seed, they are self perpetuating.

Alfalfa is the most important field crop. It generally is grown on such deep or very deep soils as the Churn, Los Robles, Molinas, Reiff, Tehama, and Vina; but it is also grown on some of the shallow soils. Much of the alfalfa is grown in the Anderson-Cottonwood Irrigation District, but it is also grown on a small acreage in the narrow valleys on the east side of the Sacramento Valley. In 1967 alfalfa was harvested on 3,000 acres in the survey area. Other field crops harvested in that year were 350 acres of barley, 340 acres of corn for grain and silage, and 50 acres of wheat.

Olives are the most extensive orchard crop in the survey area. This crop is produced almost entirely on the Red Bluff soils. Formerly, prunes were grown extensively in the vicinity of Anderson, but the only orchards of bearing prune trees now in the survey area are those that were planted during the past 10 years. The acreage of walnuts has increased during the past few years. Apples and pears of good quality can be grown at elevations of 2,000 to 3,000 feet on the Aiken soils and on other deep soils that are now wooded. In 1965 orchards of bearing apple, persimmon, peach, and cherry trees occupied 410 acres in the survey area. At that time olive orchards occupied 800 acres, and walnut orchards, 288 acres. Walnut orchards, both of bearing and nonbearing trees, occupied 572 acres; and prune orchards, both bearing and nonbearing, occupied 217 acres. Because prune trees generally are interplanted with walnut trees, however, only about 600 acres are occupied by the two kinds of trees.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil, or as inches of water for the total effective rooting depth.

Chiseling. Tillage of soil with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of predominantly illuvial clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Cobblestone. A rounded or partly rounded fragment of rock, 3 to 10 inches in diameter.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; forms a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moisture.

Cover crop. A close-growing crop grown primarily to improve and to protect the soil between periods of regular crop production; or a crop grown between trees and vines in orchards and vineyards.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A horizon and upper part of the B horizon and have mottling in the lower part of the B horizon and the C horizon.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling is absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors, such as light, moisture, temperature, and the physical condition of the soil are favorable.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Forage. Plant material that can be used as feed by domestic animals; it may be grazed or cut for hay.

Forb. Any herbaceous plant, neither a grass nor a sedge, that is grazed on western ranges.

Gravelly soil material. From 15 to 50 percent of material, by volume, consists of rounded or angular rock fragments that are not prominently flattened and are up to 3 inches in diameter.

Green manure (agronomy). A crop grown for the purpose of being turned under in an early stage of maturity or soon after maturity for soil improvement.

Ground water (geology). Water that fills all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

Habitat. The natural abode of a plant or animal; it refers to the kind of environment in which a plant or animal normally lives as opposed to its range, or geographical distribution.

490-726—74——12

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residue.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A horizon to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, generally expressed in inches per hour. It may be limited by the infiltration capacity of the soil or by the rate at which water is applied to the surface soil.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Metamorphic rocks. Rocks of any origin that have been completely changed physically by heat, pressure, and movement. Such rocks are nearly always crystalline.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Neutral soil. In practice, a soil having a pH value between 6.6 and 7.3. Strictly speaking, a soil that has a pH value of 7.0.

Pan. A layer in a soil that is firmly compacted or very rich in clay. Frequently the word "pan" is combined with other words that more explicitly indicate the nature of the layers; for example, *hardpan*, *fragipan*, *claypan*, and *traffic pan*.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Productivity (of soil). The present capability of a soil for producing a specified plant or sequence of plants under a specified system of management. It is measured in terms of output, or harvest, in relation to input of production for the specific kind of soil under a specified system of management.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. A degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour" soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Root zone. The part of the soil that is penetrated, or can be penetrated, by plant roots.

Runoff (hydraulics). The part of the precipitation upon a drainage area that is discharged from the area in stream channels. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Sedimentary rock. A rock composed of particles deposited from suspension in water. The chief sedimentary rocks are conglomerate, from gravel; sandstone, from sand; shale, from clay; and limestone, from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sands have been consolidated into sandstone.

Seepage. Slow escape of water from a soil along an extensive line of surface.

Sheet erosion. The removal of a fairly uniform layer of soil or material from the land surface by the action of rainfall and runoff water.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structures are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoiling. The tillage of the soil below the normal plow depth, generally to shatter a hardpan or claypan.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches thick. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to flooding. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tuff. Deposited volcanic ash, normally more or less stratified and consolidated.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table is separated from a lower one by a dry zone.

Water table, perched. The upper surface of a body of free ground water that is separated from an underlying body of ground water by unsaturated material.

Weathering. All physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which it belongs. A technical profile that is representative of the series is described under the series. For complete information about a capability unit, refer to the section "Management by capability units" beginning on page 73. The Storie Index is described beginning on page 83. Range management is described in the section "Use of the Soils for Range" beginning on page 86. Woodland uses of the soils and yields by site indexes are described beginning on page 91. Dashes in columns indicate the soil was not placed in a particular interpretative group. Other information is given in tables as follows:

Acreage and extent, table 1, p. 8.
Estimated yields of crops, table 2, p. 84.
Yields of ponderosa pine, table 3, p. 92.
Suitability of soils for wildlife habitat, table 4, p. 98.
Engineering uses of the soils, tables 5, 6 and 7, pp. 102 to 145.

Map symbol	Mapping unit	Page	Storie index	Capability unit		Woodland suitability group		Range site		Wildlife suitability group	
				Symbol	Page	Number	Page	Name	Page	Number	Page
AaB	Aiken loam, 0 to 8 percent slopes	11	68	IIe-1(22)	74	1	94	----------	--	8	100
AaC	Aiken loam, 8 to 15 percent slopes	11	65	IIIe-1(22)	76	1	94	----------	--	8	100
AaD	Aiken loam, 15 to 30 percent slopes	11	57	IVe-1(22)	79	2	94	----------	--	8	100
AbB	Aiken stony loam, 0 to 8 percent slopes	11	51	IVe-1(22)	79	4	95	----------	--	8	100
AbC	Aiken stony loam, 8 to 15 percent slopes	11	48	IVe-7(22)	79	4	95	----------	--	8	100
AbD	Aiken stony loam, 15 to 30 percent slopes	11	43	IVe-7(22)	79	5	96	----------	--	8	100
AcE	Aiken very stony loam, 30 to 50 percent slopes	11	21	VIs-1(22)	82	5	96	----------	--	8	100
Ad	Anderson gravelly sandy loam	12	43	IIIs-0(17)	78	---	--	----------	--	2	97
Ae	Anderson gravelly sandy loam, moderately deep	12	34	IIIs-3(17)	78	---	--	----------	--	2	97
AhB	Anita clay, 0 to 8 percent slopes	12	18	IIIw-5(17)	78	---	--	----------	--	1	97
AkB	Anita very cobbly clay, 0 to 8 percent slopes	13	9	IVw-5(17)	80	---	--	----------	--	1	97
AlB	Auberry fine sandy loam, 0 to 8 percent slopes	13	60	IIIe-1(17, 18)	76	---	--	Granitic	90	5	98
AlD	Auberry fine sandy loam, 8 to 30 percent slopes	13	42	VIe-1(15, 17,18)	81	---	--	Granitic	90	5	98
AlF	Auberry fine sandy loam, 30 to 70 percent slopes	13	12	VIIe-1(15, 18)	82	---	--	Granitic	90	5	98
AnB	Auburn loam, 0 to 8 percent slopes	14	42	IVe-8(17,18)	79	---	--	Shallow Loamy	87	5	98
AnD	Auburn loam, 8 to 30 percent slopes	14	38	VIe-1(15, 17,18)	81	---	--	Shallow Loamy	87	5	98
ArD	Auburn very stony loam, 8 to 30 percent slopes	14	25	VIs-1(15,18)	82	---	--	Shallow Loamy	87	5	98
AsD2	Auburn clay loam, 8 to 30 percent slopes, eroded	14	32	VIe-1(15, 17,18)	81	---	--	Shallow Loamy	87	5	98

Map symbol	Mapping unit	Page	Storie index	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page	Range site Name	Range site Page	Wildlife suitability group Number	Wildlife suitability group Page
AtF2	Auburn very stony clay loam, 30 to 50 percent slopes, eroded	14	9	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	5	98
AuF2	Auburn very rocky clay loam, 50 to 70 percent slopes, eroded	14	4	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	5	98
BeD	Behemotosh very stony loam, 8 to 30 percent slopes	15	26	VIs-1(22)	82	7	96	----------	--	8	100
BeE2	Behemotosh very stony loam, 30 to 50 percent slopes, eroded	15	12	VIs-1(22)	82	7	96	----------	--	8	100
BhF2	Behemotosh very rocky loam, 50 to 70 percent slopes, eroded	15	5	VIIs-1(22)	83	7	96	----------	--	8	100
BkC	Boomer gravelly loam, 0 to 15 percent slopes	16	45	IIIe-1(22)	76	4	95	----------	--	8	100
BkD	Boomer gravelly loam, 15 to 30 percent slopes	16	40	IVe-1(22)	79	5	96	----------	--	8	100
BkE	Boomer gravelly loam, 30 to 50 percent slopes	16	21	VIe-1(22)	82	5	96	----------	--	8	100
BlF	Boomer very stony loam, 50 to 70 percent slopes	16	6	VIIs-1(22)	83	6	96	----------	--	8	100
BoE3	Boomer very stony clay loam, 30 to 50 percent slopes, severely eroded	16	10	VIs-1(22)	82	7	96	----------	--	8	100
BoF3	Boomer very stony clay loam, 50 to 70 percent slopes, severely eroded	16	6	VIIs-1(22)	83	7	96	----------	--	8	100
CaE3	Chaix coarse sandy loam, 30 to 50 percent slopes, severely eroded	17	13	VIIe-1(22)	83	7	96	----------	--	8	100
CaF3	Chaix coarse sandy loam, 50 to 70 percent slopes, severely eroded	17	7	VIIe-1(22)	83	7	96	----------	--	8	100
CbD2	Chaix sandy loam, 5 to 30 percent slopes, eroded	17	34	VIe-1(22)	82	5	96	----------	--	8	100
CbE	Chaix sandy loam, 30 to 50 percent slopes	17	21	VIIe-1(22)	83	5	96	----------	--	8	100
CbF	Chaix sandy loam, 50 to 70 percent slopes	17	10	VIIe-1(22)	83	6	96	----------	--	6	99
CcA	Churn loam, 0 to 3 percent slopes	18	90	I-1(17)	73	---	--	----------	--	2	97
CcB	Churn loam, 3 to 8 percent slopes	18	86	IIe-1(17,18)	74	---	--	----------	--	2	97
CdA	Churn loam, slightly wet, 0 to 3 percent slopes	18	81	IIw-2(17,22)	75	---	--	----------	--	2	97
CeA	Churn gravelly loam, 0 to 3 percent slopes	18	72	IIs-4(17)	76	---	--	----------	--	2	97
CeB	Churn gravelly loam, 3 to 8 percent slopes	19	69	IIe-1(17,18)	74	---	--	----------	--	2	97
CfA	Churn gravelly loam, deep, 0 to 3 percent slopes	19	65	IIs-3(17)	75	---	--	----------	--	2	97
CfB	Churn gravelly loam, deep, 3 to 8 percent slopes	19	62	IIe-3(17)	74	---	--	----------	--	2	97
CgB	Clough gravelly loam, 3 to 8 percent slopes	19	20	IVe 8(17,18)	79	---	--	----------	--	2	97
Ch	Cobbly alluvial land	20	19	IVs-0(17)	80	---	--	----------	--	2	97

Map symbol	Mapping unit	Page	Storie index	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page	Range site Name	Range site Page	Wildlife suitability group Number	Wildlife suitability group Page
Ck	Cobbly alluvial land, frequently flooded	20	12	VIIw-1(17, 18)	83	---	--	----------	--	9	100
ClD	Cohasset loam, 0 to 30 percent slopes	20	62	IVe-1(22)	79	2	94	----------	--	8	100
CmD	Cohasset stony loam, 0 to 30 percent slopes	21	40	IVe-7(22)	79	2	94	----------	--	8	100
CmE	Cohasset stony loam, 30 to 50 percent slopes	21	17	VIe-1(22)	82	3	95	----------	--	8	100
CnF	Cohasset very stony loam, 50 to 70 percent slopes	21	9	VIIs-1(22)	83	3	95	----------	--	8	100
CoE	Cohasset very stony loam, moderately deep, 8 to 50 percent slopes	21	19	VIs-1(22)	82	7	96	----------	--	8	100
CpD	Cohasset-Aiken stony loams, 0 to 30 percent slopes	21	40	IVe-7(22)	79	2	94	----------	--	8	100
CrD	Cohasset-McCarthy complex, 0 to 30 percent slopes	21	39	VIe-1(22)	82	2	94	----------	--	8	100
CrE	Cohasset-McCarthy complex, 30 to 50 percent slopes	21	16	VIs-1(22)	82	5	96	----------	--	8	100
CrG	Cohasset-McCarthy complex, 50 to 75 percent slopes	21	7	VIIs-1(22)	83	6	96	----------	--	8	100
CsF	Colluvial land	22	15	VIIs-1(22)	83	6	96	----------	--	8	100
CtC	Cone gravelly loam, 3 to 15 percent slopes	22	51	IIIe-1(22)	76	4	95	----------	--	8	100
CtD	Cone gravelly loam, 15 to 30 percent slopes	22	40	IVe-1(22)	79	5	96	----------	--	8	100
CuD	Cone stony loam, 3 to 30 percent slopes	22	37	IVe-7(22)	79	5	96	----------	--	8	100
CvE	Cone very stony loam, 30 to 50 percent slopes	23	17	VIs-1(22)	82	5	96	----------	--	8	100
CwF	Cone very stony loam, moderately deep, 15 to 60 percent slopes	23	19	VIIs-1(22)	83	5	96	----------	--	8	100
CxE	Corbett loamy coarse sand, 15 to 50 percent slopes	23	27	VIe-1(22)	82	5	96	----------	--	8	100
CxF3	Corbett loamy coarse sand, 30 to 70 percent slopes, severely eroded	23	7	VIIe-1(22)	83	6	96	----------	--	8	100
CxG	Corbett loamy coarse sand, 50 to 80 percent slopes	23	10	VIIe-1(22)	83	6	96	----------	--	8	100
CyG	Corbett very rocky loamy coarse sand, 30 to 80 percent slopes	23	9	VIIs-1(22)	83	7	96	----------	--	8	100
DfD2	Diamond Springs very stony loam, 8 to 30 percent slopes, eroded	24	33	VIs-1(22)	82	7	96	----------	--	8	100
DgE2	Diamond Springs very rocky sandy loam, 30 to 50 percent slopes, eroded	24	15	VIIs-1(22)	83	7	96	----------	--	8	100
DgE3	Diamond Springs very rocky sandy loam, 30 to 50 percent slopes, severely eroded	24	13	VIIs-1(22)	83	7	96	----------	--	8	100
FaD	Forward sandy loam, 5 to 30 percent slopes	25	34	VIe-1(22)	82	5	96	----------	--	8	100
FaE	Forward sandy loam, 30 to 50 percent slopes	25	19	VIIe-1(22)	83	5	96	----------	--	8	100
FdD	Forward sandy loam, deep, 0 to 30 percent slopes	25	51	IVe-1(22)	79	5	96	----------	--	8	100

Map symbol	Mapping unit	Page	Storie index	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page	Range site Name	Range site Page	Wildlife suitability group Number	Wildlife suitability group Page
GaC	Gaviota fine sandy loam, 3 to 15 percent slopes-----	25	32	VIe-1(15, 17,18)	81	---	--	Shallow Loamy	87	5	98
GaD	Gaviota fine sandy loam, 15 to 30 percent slopes----	26	29	VIe-1(15, 17,18)	81	---	--	Shallow Loamy	87	5	98
GbD	Gaviota very rocky sandy loam, 0 to 30 percent slopes----------------	26	17	VIs-1(15,18)	82	---	--	Shallow Loamy	87	5	98
GbE2	Gaviota very rocky sandy loam, 30 to 50 percent slopes, eroded------------	26	6	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	6	99
GdD	Goulding very stony loam, 10 to 30 percent slopes----	26	17	VIs-1(15,18)	82	---	--	Shallow Loamy	87	5	98
GeE2	Goulding very rocky loam, 30 to 50 percent slopes, eroded--------------------	26	6	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	5	98
GeF2	Goulding very rocky loam, 50 to 70 percent slopes, eroded--------------------	27	2	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	6	99
Gp	Gravel pits------------------	27	< 5	VIIIw-1(17)	83	---	--	----------	--	2	97
GsD	Guenoc very stony loam, 0 to 30 percent slopes-----	27	36	VIs-1(15,18)	82	---	--	Shallow Loamy	87	5	98
GuD	Guenoc very rocky loam, 0 to 30 percent slopes-----	27	19	VIs-1(15,18)	82	---	--	Shallow Loamy	87	5	98
GuE	Guenoc very rocky loam, 30 to 50 percent slopes----	28	12	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	5	98
HaF	Henneke very rocky loam, 15 to 60 percent slopes----	28	3	VIIs-1(15, 17,18)	83	---	--	Very Shallow Loamy	91	5	98
Hb	Hillgate loam----------------	29	54	IVs-3(17)	80	---	--	----------	--	2	97
HcE	Holland sandy loam, 15 to 50 percent slopes-------------	29	42	VIe-1(22)	82	5	96	----------	--	8	100
HcF	Holland sandy loam, 15 to 70 percent slopes-------------	29	14	VIIe-1(22)	83	6	96	----------	--	8	100
Hd	Honcut loam------------------	30	100	I-1(17)	73	---	--	----------	--	2	97
He	Honcut gravelly loam---------	30	75	IIs-4(17)	76	---	--	----------	--	2	97
Hf	Honcut gravelly loam, deep---	30	64	IIs-0(17)	75	---	--	----------	--	2	97
HgA	Honn fine sandy loam, 0 to 3 percent slopes-------------	31	81	I-1(17)	73	---	--	----------	--	2	97
HgB	Honn fine sandy loam, 3 to 8 percent slopes-------------	31	77	IIe-1(17,18)	74	---	--	----------	--	2	97
HhA	Honn gravelly sandy loam, 0 to 3 percent slopes------	31	57	IIs-4(17)	76	---	--	----------	--	2	97
IaB	Igo gravelly loam, 0 to 8 percent slopes-------------	32	13	VIIs-1(15, 17,18)	83	---	--	Very Shallow Loamy	91	3	97
IbD	Inks gravelly loam, 8 to 30 percent slopes-------------	32	20	VIe-1(15, 17,18)	81	---	--	Shallow Loamy	87	5	98
IdD	Inks very stony loam, 3 to 30 percent slopes----------	32	17	VIs-1(15,18)	82	---	--	Shallow Loamy	87	5	98

Map symbol	Mapping unit	Page	Storie index	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page	Range site Name	Range site Page	Wildlife suitability group Number	Wildlife suitability group Page
IdE	Inks very stony loam, 30 to 50 percent slopes----------	32	8	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	5	98
IeD	Inks-Pentz complex, 5 to 30 percent slopes----------	32	16	VIs-1(15,18)	82	---	--	Shallow Loamy	87	5	98
IeE	Inks-Pentz complex, 30 to 50 percent slopes----------	33	8	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	5	98
JbD	Josephine gravelly loam, 10 to 30 percent slopes----	34	48	IVe-1(22)	79	2	94	----------	--	8	100
JbE	Josephine gravelly loam, 30 to 50 percent slopes----	34	24	VIe-1(22)	82	5	96	----------	--	8	100
JbF	Josephine gravelly loam, 50 to 70 percent slopes----	34	11	VIIe-1(22)	83	6	96	----------	--	8	100
JdD	Josephine gravelly loam, moderately deep, 10 to 30 percent slopes-------------	34	40	IVe-8(22)	80	5	96	----------	--	8	100
JdE	Josephine gravelly loam, moderately deep, 30 to 50 percent slopes-------------	34	20	VIe-1(22)	82	5	96	----------	--	8	100
JsF	Josephine-Sheetiron complex, 50 to 70 percent slopes----	34	5	VIIs-1(22)	83	6	96	----------	--	8	100
KbC	Kanaka sandy loam, 3 to 15 percent slopes-------------	35	55	IVe-8(17,18)	79	---	--	Granitic	90	5	98
KcD	Kanaka rocky sandy loam, 5 to 30 percent slopes-----	35	35	VIe-1(15, 17,18)	81	---	--	Granitic	90	5	98
KcE	Kanaka rocky sandy loam, 30 to 50 percent slopes----	35	15	VIIe-1(15, 18)	82	---	--	Granitic	90	5	98
KcF2	Kanaka rocky sandy loam, 50 to 70 percent slopes, eroded--------------------	35	6	VIIe-1(15, 18)	82	---	--	Granitic	90	5	98
KdA	Keefers gravelly loam, 0 to 3 percent slopes-----------	36	37	IIIs-3(17)	78	---	--	----------	--	5	98
KdB	Keefers gravelly loam, 3 to 8 percent slopes-----------	36	35	IIIe-3(17, 22)	77	---	--	----------	--	5	98
KeB	Keefers cobby loam, channeled, 1 to 5 percent slopes---------------------	36	2	IVw-2(17)	80	---	--	----------	--	5	98
KgF2	Kidd very rocky loam, 10 to 60 percent slopes, eroded--	36	5	VIIs-1(15, 17,18)	83	---	--	Very Shallow Very Rocky	90	6	99
KhC	Kilarc sandy clay loam, 2 to 15 percent slopes-----	37	41	IIIe-3(17, 22)	77	---	--	Fine Loamy	89	---	--
KhD	Kilarc sandy clay loam, 15 to 30 percent slopes----	37	34	IVe-3(17, 18,22)	79	---	--	Fine Loamy	89	---	--
KhE	Kilarc sandy clay loam, 30 to 50 percent slopes----	37	18	VIe-1(22)	82	---	--	Fine Loamy	89	---	--
KlD	Kilarc very stony sandy clay loam, 10 to 30 percent slopes---------------------	37	22	VIs-1(22)	82	---	--	Fine Loamy	89	5	98
KlE	Kilarc very stony sandy clay loam, 30 to 50 percent slopes---------------------	38	11	VIs-1(22)	82	---	--	Fine Loamy	89	5	98
KsD	Kilarc-Sites complex, 8 to 30 percent slopes----------	38	33	VIs-1(22)	82	---	--	Fine Loamy	89	5	98

Map symbol	Mapping unit	Page	Storie index	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page	Range site Name	Range site Page	Wildlife suitability group Number	Wildlife suitability group Page
LaE	Landslides------------------	38	--	VIIIs-1(15, 18,22)	83	---	--	----------	--	5	98
LbE	Lodo shaly loam, 10 to 50 percent slopes------------	38	7	VIIs-1(15, 17,18)	83	---	--	Very Shallow Loamy	91	3	97
LbF3	Lodo shaly loam, 50 to 70 percent slopes, severely eroded--------------------	38	2	VIIIs-1(15, 18,22)	83	---	--	----------	--	3	97
LcA	Los Robles loam, 0 to 3 percent slopes------------	39	95	I-1(17)	73	---	--	----------	--	2	97
LcB	Los Robles loam, 3 to 8 percent slopes------------	39	90	IIe-1(17,18)	74	---	--	----------	--	2	97
LdA	Los Robles loam, seeped, 0 to 3 percent slopes------	39	86	IIw-2(17,22)	75	---	--	----------	--	2	97
LeB	Los Robles loam, moderately deep, 0 to 5 percent slopes--------------------	39	68	IIIe-1(17, 18)	76	---	--	----------	--	2	97
LfA	Los Robles gravelly loam, 0 to 3 percent slopes------	39	68	IIs-4(17)	76	---	--	----------	--	2	97
LgE	Lyonsville-Jiggs complex, 10 to 50 percent slopes----	40	16	VIs-1(22)	82	5	96	----------	--	9	100
LhE	Lyonsville-Jiggs complex, deep, 10 to 50 percent slopes--------------------	40	21	VIs-1(22)	82	3	95	----------	--	8	100
LkF	Lyonsville and Jiggs soils, 50 to 70 percent slopes----	41	6	VIIs-1(22)	83	6	96	----------	--	8	100
MaE	Marpa gravelly loam, 30 to 50 percent slopes---------	41	15	VIe-1(22)	82	5	96	----------	--	8	100
MaG	Marpa gravelly loam, 50 to 75 percent slopes---------	41	7	VIIe-1(22)	83	6	96	----------	--	8	100
MbG2	Maymen very stony loam, 30 to 80 percent slopes, eroded--------------------	42	3	VIIs-1(15, 17,18)	83	---	--	Very Shallow Loamy	91	6	99
McD	Millsap loam, 5 to 30 percent slopes------------	43	46	IVe-3(17, 18,22)	79	---	--	Loamy	89	5	98
McE	Millsap loam, 30 to 50 percent slopes------------	43	23	VIe-1(15, 17,18)	81	---	--	Loamy	89	5	98
McG	Millsap loam, 50 to 75 percent slopes------------	43	10	VIIe-1(15, 18)	82	---	--	Loamy	89	5	98
MdE	Millsap very rocky loam, 10 to 50 percent slopes----	43	18	VIs-1(15,18)	82	---	--	Loamy	89	5	98
MeD	Millsholm gravelly loam, 3 to 30 percent slopes-----	43	23	VIe-1(15, 17,18)	81	---	--	Shallow Loamy	87	5	98
MeD2	Millsholm gravelly loam, 3 to 30 percent slopes, eroded--------------------	44	18	VIe-1(15, 17,18)	81	---	--	Shallow Loamy	87	5	98
MeE	Millsholm gravelly loam, 30 to 50 percent slopes----	44	11	VIIe-1(15, 18)	82	---	--	Shallow Loamy	87	5	98
MeG	Millsholm gravelly loam, 50 to 75 percent slopes----	44	5	VIIe-1(15, 18)	82	---	--	Shallow Loamy	87	5	98

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Storie index	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page	Range site Name	Range site Page	Wildlife suitability group Number	Wildlife suitability group Page
MfE2	Millsholm very rocky loam, 30 to 50 percent slopes, eroded	44	6	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	5	98
MfF2	Millsholm very rocky loam, 50 to 70 percent slopes, eroded	44	3	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	5	98
MgA	Moda loam, 0 to 3 percent slopes	44	32	IIIs-3(17)	78	---	--	----------	--	2	97
MhA	Moda loam, seeped, 0 to 3 percent slopes	45	24	IVw-2(17)	80	---	--	----------	--	2	97
MkB	Moda loam, shallow, 0 to 5 percent slopes	45	23	IVs-3(17)	80	---	--	----------	--	2	97
Mm	Molinos sandy loam, channeled	45	48	IVw-2(17)	80	---	--	----------	--	2	97
Mn	Molinos fine sandy loam	45	100	I-1(17)	73	---	--	----------	--	2	97
Mo	Molinos fine sandy loam, seeped	46	90	IIw-2(17,22)	75	---	--	----------	--	2	97
MrA	Myers silty clay, 0 to 3 percent slopes	46	60	IIs-5(17)	76	---	--	----------	--	4	97
MrB	Myers silty clay, 3 to 8 percent slopes	46	57	IIe-5(17)	75	---	--	----------	--	4	97
NaB	Nanny gravelly sandy loam, 0 to 8 percent slopes	47	63	IIIe-1(22)	76	1	94	----------	--	8	100
NbB	Nanny stony sandy loam, 0 to 8 percent slopes	47	56	IVe-7(22)	79	1	94	----------	--	8	100
NcB	Nanny-Windy complex, 0 to 8 percent slopes	47	24	IIIe-1(22)	76	1	94	----------	--	8	100
NdE	Neuns very stony loam, 8 to 50 percent slopes	48	16	VIs-1(22)	82	5	96	----------	--	8	100
NdG	Neuns very stony loam, 50 to 80 percent slopes	48	5	VIIs-1(22)	83	6	96	----------	--	8	100
NeC	Newtown gravelly loam, 8 to 15 percent slopes	49	35	IIIe-3(17, 22)	77	---	--	Upland Terrace	88	5	98
NeD	Newtown gravelly loam, 15 to 30 percent slopes	49	31	IVe-3(17, 18,22)	79	---	--	Upland Terrace	88	5	98
NeE2	Newtown gravelly loam, 30 to 50 percent slopes, eroded	49	11	VIe-1(15, 17,18)	81	---	--	Upland Terrace	88	5	98
NfE2	Newtown stony loam, 8 to 50 percent slopes, eroded	49	11	VIe-1(15, 17,18)	81	---	--	Upland Terrace	88	5	98
PcD	Parrish loam, 8 to 30 percent slopes	50	46	IVe-8(17,18)	79	---	--	Loamy	89	5	98
PcE	Parrish loam, 30 to 50 percent slopes	50	24	VIe-1(15, 17,18)	81	---	--	Loamy	89	5	98
PcF	Parrish loam, 50 to 70 percent slopes	50	11	VIIe-1(15, 18)	82	---	--	Loamy	89	5	98
PfF	Pentz-Supan complex, 50 to 70 percent slopes	50	4	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	5	98
PlA	Perkins loam, 0 to 3 percent slopes	52	73	IIs-3(17)	75	---	--	----------	--	2	97
PmA	Perkins gravelly loam, 0 to 3 percent slopes	52	61	IIs-3(17)	75	---	--	----------	--	2	97

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Storie index	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page	Range site Name	Range site Page	Wildlife suitability group Number	Wildlife suitability group Page
PmB	Perkins gravelly loam, 3 to 8 percent slopes------	52	55	IIe-3(17)	74	---	--	----------	--	2	97
PmC	Perkins gravelly loam, 8 to 15 percent slopes-----	52	51	IIIe-3(17, 22)	77	---	--	----------	--	2	97
PmD	Perkins gravelly loam, 15 to 30 percent slopes----	52	45	IVe-3(17, 18,22)	79	---	--	----------	--	2	97
PnA	Perkins gravelly loam, seeped, 0 to 3 percent slopes--------------------	52	48	IIw-2(17,22)	75	---	--	----------	--	2	97
PoA	Perkins gravelly loam, moderately deep, 0 to 3 percent slopes------------	52	54	IIIs-3(17)	78	---	--	----------	--	2	97
PoB	Perkins gravelly loam, moderately deep, 3 to 8 percent slopes------------	53	49	IIIe-3(17, 22)	77	---	--	----------	--	2	97
RbA	Red Bluff loam, 0 to 3 percent slopes------------	53	58	IIIs-9(17)	78	---	--	Acid Terrace	87	5	98
RbB	Red Bluff loam, 3 to 8 percent slopes------------	53	52	IIIe-9(17)	77	---	--	Acid Terrace	87	5	98
RcA	Red Bluff gravelly loam, moderately deep, 0 to 3 percent slopes------------	54	45	IIIs-9(17)	78	---	--	Acid Terrace	87	5	98
RcB	Red Bluff gravelly loam, moderately deep, 3 to 8 percent slopes------------	54	40	IIIe-9(17)	77	---	--	Acid Terrace	87	5	98
RdA	Redding gravelly loam, 0 to 3 percent slopes----------	55	17	IVs-8(17)	81	---	--	Acid Terrace	87	5	98
RdB	Redding gravelly loam, 3 to 8 percent slopes----------	55	16	IVe-8(17,18)	79	---	--	Acid Terrace	87	5	98
ReA	Redding-Red Bluff gravelly loams, 0 to 3 percent slopes--------------------	55	27	IVs-8(17)	81	---	--	Acid Terrace	87	5	98
ReB	Redding-Red Bluff gravelly loams, 3 to 8 percent slopes--------------------	55	25	IVe-8(17,18)	79	---	--	Acid Terrace	87	5	98
RfB	Reiff sandy loam, channeled, 0 to 8 percent slopes------	57	46	IVw-2(17)	80	---	--	----------	--	2	97
RgA	Reiff fine sandy loam, 0 to 3 percent slopes----------	57	95	I-1(17)	73	---	--	----------	--	2	97
RgB	Reiff fine sandy loam, 3 to 8 percent slopes----------	57	90	IIe-1(17,18)	74	---	--	----------	--	2	97
RhA	Reiff fine sandy loam, deep, 0 to 3 percent slopes------	57	62	IIs-0(17)	75	---	--	----------	--	2	97
RkA	Reiff gravelly fine sandy loam, deep, 0 to 3 percent slopes------------	57	64	IIIs-0(17)	78	---	--	----------	--	2	97
RlA	Reiff loam, 0 to 3 percent slopes--------------------	57	95	I-1(17)	73	---	--	----------	--	2	97
RmA	Reiff loam, seeped, 0 to 3 percent slopes------------	57	76	IIw-2(17,22)	75	---	--	----------	--	2	97
RnA	Reiff gravelly loam, 0 to 3 percent slopes----------	57	72	IIs-4(17)	76	---	--	----------	--	2	97
RoA	Reiff gravelly loam, slightly wet, 0 to 3 percent slopes------------	58	65	IIw-2(17,22)	75	---	--	----------	--	2	97
Rw	Riverwash--------------------	58	< 5	VIIIw-1(17)	83	---	--	----------	--	10	100
RxF	Rock land--------------------	58	< 5	VIIIs-1(15, 18,22)	83	---	--	----------	--	8	100

Map symbol	Mapping unit	Page	Storie index	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page	Range site Name	Range site Page	Wildlife suitability group Number	Wildlife suitability group Page
RyF	Rubble land------------------	58	< 5	VIIIs-1(15, 18,22)	83	---	--	----------	--	8	100
ScB	Sehorn silty clay, 3 to 8 percent slopes-------------	59	43	IIIe-5(15)	77	---	--	Clayey	89	4	97
ScD	Sehorn silty clay, 8 to 30 percent slopes-------------	59	35	IVe-5(15)	79	---	--	Clayey	89	4	97
ScE	Sehorn silty clay, 30 to 50 percent slopes----------	59	18	VIe-1(15, 17,18)	81	---	--	Clayey	89	4	97
SdD2	Sehorn very stony silty clay, 8 to 30 percent slopes, eroded------------	59	25	VIs-1(15,18)	82	---	--	Clayey	89	4	97
SeD	Sehorn silty clay, moderately deep, 8 to 30 percent slopes-------------	59	24	IVe-5(15)	79	---	--	Clayey	89	4	97
SeE	Sehorn silty clay, moderately deep, 30 to 50 percent slopes-------------	59	13	VIe-1(15, 17,18)	81	---	--	Clayey	89	4	97
SfF2	Sehorn complex, 50 to 70 percent slopes, eroded-----	59	7	VIIe-1(15, 18)	82	---	--	Clayey	89	4	97
SgE	Sheetiron very stony loam, 30 to 50 percent slopes----	60	13	VIs-1(22)	82	5	96	----------	--	8	100
SgF	Sheetiron very stony loam, 50 to 75 percent slopes----	60	5	VIIs-1(22)	83	6	96	----------	--	8	100
SgG	Sheetiron very stony loam, 75 to 90 percent slopes----	60	4	VIIIs-1(15, 18,22)	83	---	--	----------	--	8	100
ShB	Shingletown clay loam, 0 to 8 percent slopes-----------	61	47	IIw-2(17,22)	75	---	--	----------	--	7	100
SkA	Shingletown loam, drained, 0 to 3 percent slopes------	61	73	IIw-2(17,22)	75	---	--	----------	--	7	100
SmB	Sierra sandy loam, 3 to 8 percent slopes-------------	61	61	IIe-1(17,18)	74	---	--	Granitic	90	5	98
SmC	Sierra sandy loam, 8 to 15 percent slopes-------------	62	58	IIIe-1(17, 18)	76	---	--	Granitic	90	5	98
SmD	Sierra sandy loam, 15 to 30 percent slopes-------------	62	51	IVe-1(18)	78	---	--	Granitic	90	5	98
SmD3	Sierra sandy loam, 15 to 30 percent slopes, severely eroded--------------------	62	36	VIe-1(15, 17,18)	81	---	--	Granitic	90	5	98
SmE	Sierra sandy loam, 30 to 50 percent slopes-------------	62	25	VIe-1(15, 17,18)	81	---	--	Granitic	90	5	98
SnC	Sites loam, 5 to 15 percent slopes--------------------	63	65	IIIe-1(22)	76	4	95	----------	--	8	100
SnD	Sites loam, 15 to 30 percent slopes-------------	63	57	IVe-1(22)	79	5	96	----------	--	8	100
SnE	Sites loam, 30 to 50 percent slopes-------------	63	30	VIe-1(22)	82	5	96	----------	--	8	100
SnF	Sites loam, 50 to 70 percent slopes-------------	63	14	VIIe-1(22)	83	6	96	----------	--	8	100
SoD	Sites stony loam, 8 to 30 percent slopes-------------	63	49	IVe-7(22)	79	5	96	----------	--	8	100
SpE	Sites very rocky loam, 30 to 50 percent slopes----------	63	18	VIs-1(22)	82	5	96	----------	--	8	100
SrA	Spreckels sandy loam, 0 to 3 percent slopes-----------	64	30	IIIs-3(17)	78	---	--	----------	--	2	97

Map symbol	Mapping unit	Page	Storie index	Capability unit Symbol	Capability unit Page	Woodland suitability group Number	Woodland suitability group Page	Range site Name	Range site Page	Wildlife suitability group Number	Wildlife suitability group Page
SrB	Spreckels sandy loam, 3 to 8 percent slopes-----------	64	28	IIIe-3(17, 22)	77	---	--	----------	--	2	97
SsE	Stonyford very stony loam, 30 to 50 percent slopes----	64	9	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	6	99
SsG	Stonyford very stony loam, 50 to 75 percent slopes----	64	5	VIIs-1(15, 17,18)	83	---	--	Shallow Loamy	87	6	99
StC	Supan gravelly loam, 5 to 15 percent slopes----------	65	42	IIIe-8(18)	77	---	--	Loamy	89	5	98
StD	Supan gravelly loam, 15 to 30 percent slopes----------	65	37	IVe-8(17,18)	79	---	--	Loamy	89	5	98
StE	Supan gravelly loam, 30 to 50 percent slopes----------	65	19	VIe-1(15, 17,18)	81	---	--	Loamy	89	5	98
SuD	Supan very stony loam, 0 to 30 percent slopes----------	65	30	VIs-1(15,18)	82	---	--	Loamy	89	5	98
SuE	Supan very stony loam, 30 to 50 percent slopes----------	65	15	VIs-1(15,18)	82	---	--	Loamy	89	5	98
TaD	Tailings and Placer diggings------------------	66	< 5	VIIIs-1(15, 18,22)	83	---	--	----------	--	10	100
TbA	Tehama loam, 0 to 3 percent slopes--------------------	67	72	IIs-3(17)	75	---	--	----------	--	2	97
TbB	Tehama loam, 3 to 8 percent slopes--------------------	67	61	IIe-3(17)	74	---	--	----------	--	2	97
TbC	Tehama loam, 8 to 15 percent slopes------------	67	57	IIIe-3(17, 22)	77	---	--	----------	--	2	97
TcE	Toomes very rocky loam, 0 to 50 percent slopes-----	67	4	VIIs-1(15, 17,18)	83	---	--	Very Shallow Very Rocky	90	3	97
TeD	Toomes very stony loam, 0 to 30 percent slopes-----	68	11	VIIs-1(15, 17,18)	83	---	--	Very Shallow Very Rocky	90	5	98
TfA	Tujunga loamy sand, 0 to 3 percent slopes-------------	68	58	IVs-4(17)	81	---	--	----------	--	2	97
TfB	Tujunga loamy sand, 3 to 8 percent slopes-------------	68	55	IVs-4(17)	81	---	--	----------	--	2	97
ThA	Tuscan cobbly loam, 0 to 3 percent slopes-------------	69	15	IVs-8(17)	81	---	--	----------	--	2	97
ThB	Tuscan cobbly loam, 3 to 8 percent slopes-------------	69	15	IVe-8(17,18)	79	---	--	----------	--	2	97
VeA	Vina loam, 0 to 3 percent slopes--------------------	69	100	I-1(17)	73	---	--	----------	--	2	97
VfA	Vina loam, seeped, 0 to 3 percent slopes-------------	69	90	IIw-2(17,22)	75	---	--	----------	--	2	97
VgB	Vina gravelly loam, 3 to 8 percent slopes-------------	70	68	IIe-1(17,18)	74	---	--	----------	--	2	97
Wa	Wet alluvial land------------	70	20	IIIw-5(17)	78	---	--	----------	--	2	97

Map symbol	Mapping unit	Page	Storie index	Capability unit		Woodland suitability group		Range site		Wildlife suitability group	
				Symbol	Page	Number	Page	Name	Page	Number	Page
WeD	Windy and McCarthy stony sandy loams, 0 to 30 percent slopes-------------	70	41	VIe-1(22)	82	5	96	----------	--	8	100
WfE	Windy and McCarthy very stony sandy loams, 30 to 50 percent slopes----------	71	17	VIs-1(22)	82	5	96	----------	--	8	100
WfG	Windy and McCarthy very stony sandy loams, 50 to 75 percent slopes----------	71	7	VIIs-1(22)	83	6	96	----------	--	6	99
WgE	Windy and McCarthy very rocky sandy loams, 8 to 50 percent slopes----------	71	14	VIs-1(22)	82	7	96	----------	--	4	97

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SOIL ASSOCIATIONS*

SOILS OF MOUNTAINS

1 — Cohasset-Windy-McCarthy association: Nearly level to very steep, well-drained very gravelly or very cobbly sandy loams and loams to gravelly and very cobbly clay loams underlain by basic volcanic rocks; nonstony to very stony on the surface

2 — Josephine-Marpa-Sheetiron association: Strongly sloping to very steep, well-drained and somewhat excessively drained gravelly and very gravelly loams and clay loams underlain by sedimentary and metamorphic rocks

3 — Chaix-Corbett association: Gently sloping to very steep, well-drained to excessively drained sandy loams and loamy coarse sands underlain by granitic rocks

4 — Maymen-Stonyford association: Steep and very steep, somewhat excessively drained and well-drained gravelly loams and gravelly clay loams underlain by sedimentary, metamorphic, and metamorphosed basic rocks; very stony on the surface

SOILS OF FOOTHILLS

5 — Millsholm-Sehorn-Gaviota association: Nearly level to very steep, well-drained and somewhat excessively drained sandy loams to loams and silty clays to silty clay loams underlain by sedimentary and metamorphic rocks; nonstony to very stony on the surface

6 — Kilarc-Sites association: Nearly level to very steep, moderately well drained and well drained clays and clay loams underlain by sedimentary and metamorphic rocks; nonstony to very stony on the surface

7 — Auburn-Goulding-Neuns association: Nearly level to very steep, well-drained gravelly loams and clay loams and very gravelly silty clay loams underlain by partly metamorphosed volcanic rocks; nonstony to very stony on the surface

8 — Toomes-Guenoc-Supan association: Nearly level to steep, well drained and somewhat excessively drained stony loams and gravelly to very cobbly clay loams underlain by volcanic rocks; nonstony to very stony on the surface

SOILS OF TERRACES, VALLEY BOTTOMS, AND FLOOD PLAINS

9 — Newtown-Red Bluff association: Nearly level to steep, well drained and moderately well drained clays and clay loams formed in old alluvium on high terraces

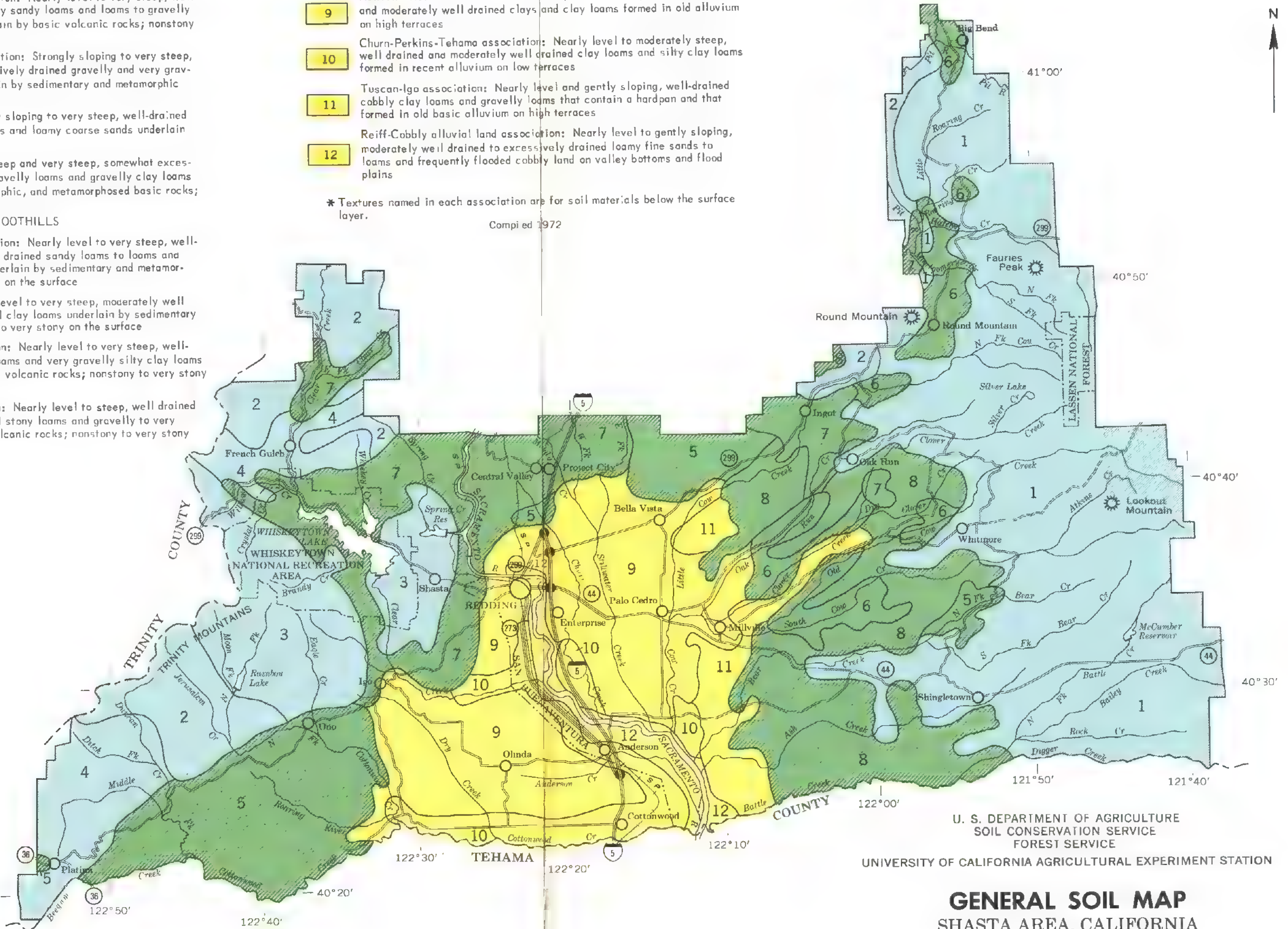
10 — Churn-Perkins-Tehama association: Nearly level to moderately steep, well drained and moderately well drained clay loams and silty clay loams formed in recent alluvium on low terraces

11 — Tuscan-Igo association: Nearly level and gently sloping, well-drained cobbly clay loams and gravelly loams that contain a hardpan and that formed in old basic alluvium on high terraces

12 — Reiff-Cobbly alluvial land association: Nearly level to gently sloping, moderately well drained to excessively drained loamy fine sands to loams and frequently flooded cobbly land on valley bottoms and flood plains

* Textures named in each association are for soil materials below the surface layer.

Compiled 1972

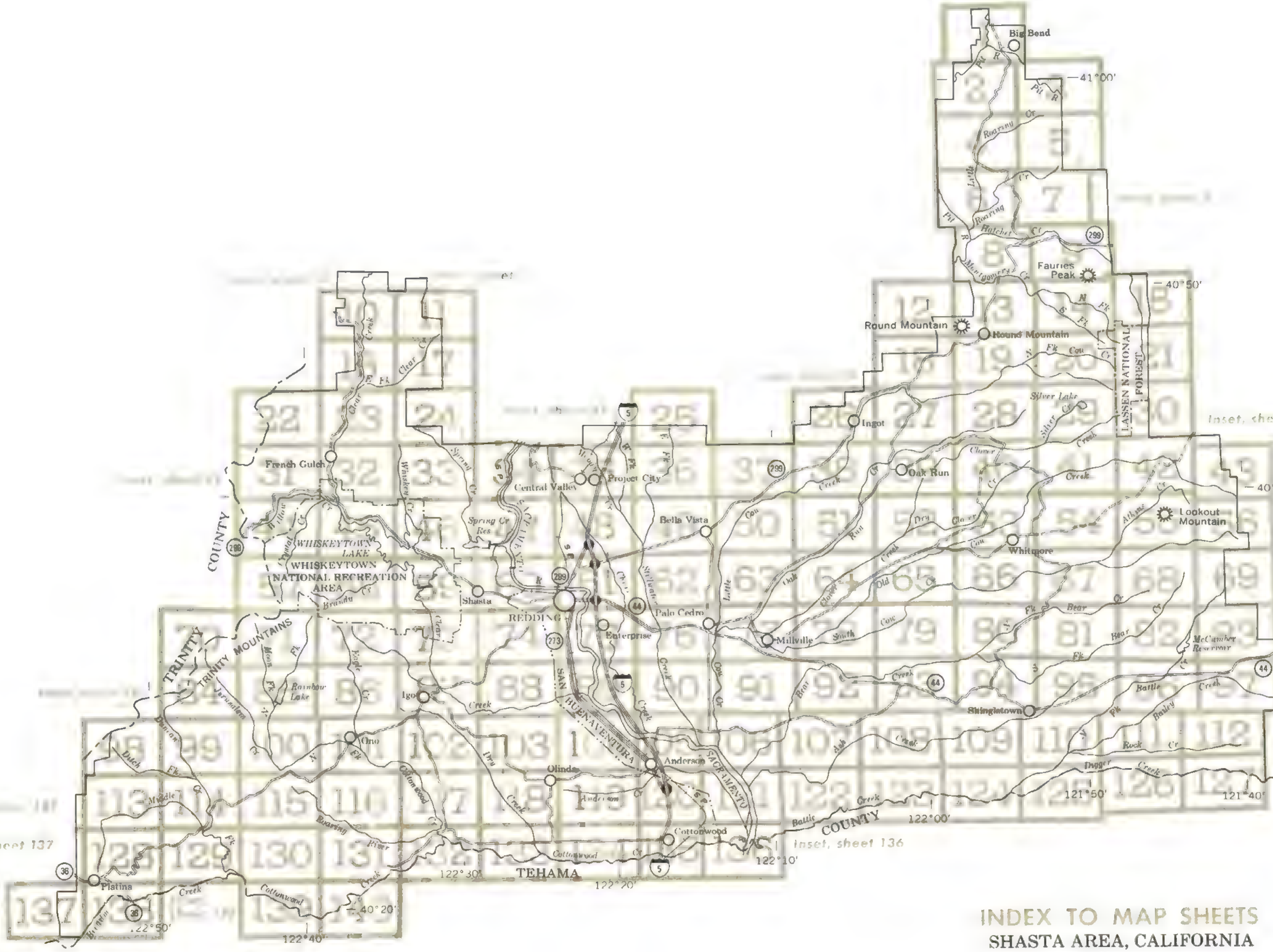


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE
UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
SHASTA AREA, CALIFORNIA

Scale 1:380 160
1 0 1 2 3 4 5 6 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS
SHASTA AREA, CALIFORNIA

Scale 1:80,000 (partly illegible)

1 0 1 2 3 4 5 6 Miles

LOCATION OF PROFILES REPRESENTATIVE OF SOIL SERIES

SOIL SERIES	SITE NUMBER	MAP SHEET NUMBER
Aiken	1	94
Anderson	2	104
Anita	3	92
Auberry	4	88
Auburn	5	74
Behemotosh	6	33
Boomer	7	59
Chaix	8	85
Churn	9	133
Clough	10	62
Conassett	11	95
Cone	12	108
Corbett	13	44
Diamond Springs	14	60
Forward	15	111
Gaviota	16	36
Goulding	17	51
Guenoc	18	78
Henneke	19	100
Hillgate	20	106
Holland	65	44
Honcut	21	76
Honn	22	77
Igo	23	91
Inks	24	106
Jiggs	25	56
Josephine	26	10
Kanaka	27	59
Keefers	28	91
Kidd	29	46
Kilarc	30	66
Lodo	31	115
Los Robles	32	90
Lyonsville	33	56
Marpa	34	18
Maymen	35	23
McCarthy	36	95
Millsap	37	115
Millsholm	38	129
Moda	39	134
Molinos	40	136
Myers	41	64
Nanny	42	97
Neuns	43	58
Newtown	44	118
Parrish	45	100
Pentz	46	63
Perkins	47	134
Red Bluff	48	90
Redding	49	120
Reiff	50	104
Sehorn	51	64
Sheetiron	52	98
Shingletown	53	82
Sierra	54	87
Sites	55	2
Spreckels	56	63
Stonyford	57	45
Supan	58	123
Tehama	59	132
Toomes	60	107
Tujunga	61	104
Tuscan	62	122
Vina	63	106
Windy	64	55

SHASTA AREA, CALIFORNIA
CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry — FY
- Ford — FORD
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipe line

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial — water, w
- Intermittent — int

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions — Large, Small
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary — Dx
- and symbol
- Gravel
- Stoniness: Stony; Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Site of profile representative of soil series — S

SOIL LEGEND

Each symbol consists of letters or a combination of letters and numbers. The first capital letter is the initial one of the soil name. A second capital letter, if used, shows the class of slope. Symbols without a slope letter are for nearly level soils. A final number, 2 or 3, in a symbol shows that the soil is named as eroded or severely eroded.

SYMBOL	NAME
AaB	Aiken loam, 0 to 8 percent slopes
AaC	Aiken loam, 8 to 15 percent slopes
AaD	Aiken loam, 15 to 30 percent slopes
AbB	Aiken stony loam, 0 to 8 percent slopes
AbC	Aiken stony loam, 8 to 15 percent slopes
AbD	Aiken stony loam, 15 to 30 percent slopes
AcE	Aiken very stony loam, 30 to 50 percent slopes
Ad	Anderson gravelly sandy loam
Ae	Anderson gravelly sandy loam, moderately deep
AhB	Anita clay, 0 to 8 percent slopes
AkB	Anita very cobbly clay, 0 to 8 percent slopes
AlB	Auberry fine sandy loam, 0 to 8 percent slopes
AlD	Auberry fine sandy loam, 8 to 30 percent slopes
AlF	Auberry fine sandy loam, 30 to 70 percent slopes
AnB	Auburn loam, 0 to 8 percent slopes
AnD	Auburn loam, 8 to 30 percent slopes
ArD	Auburn very stony loam, 8 to 30 percent slopes
AsD2	Auburn clay loam, 8 to 30 percent slopes, eroded
AtE2	Auburn very stony clay loam, 30 to 50 percent slopes, eroded
AuF2	Auburn very rocky clay loam, 50 to 70 percent slopes, eroded
BeD	Behemotosh very stony loam, 8 to 30 percent slopes
BeE2	Behemotosh very stony loam, 30 to 50 percent slopes, eroded
BhF2	Behemotosh very rocky loam, 50 to 70 percent slopes, eroded
BkC	Boomer gravelly loam, 0 to 15 percent slopes
BkD	Boomer gravelly loam, 15 to 30 percent slopes
BkE	Boomer gravelly loam, 30 to 50 percent slopes
BlF	Boomer very stony loam, 50 to 70 percent slopes
BoE3	Boomer very stony clay loam, 30 to 50 percent slopes, severely eroded
BoF3	Boomer very stony clay loam, 50 to 70 percent slopes, severely eroded
CaE3	Chaix coarse sandy loam, 30 to 50 percent slopes, severely eroded
CaF3	Chaix coarse sandy loam, 50 to 70 percent slopes, severely eroded
CbD2	Chaix sandy loam, 5 to 30 percent slopes, eroded
CbE	Chaix sandy loam, 30 to 50 percent slopes
CbF	Chaix sandy loam, 50 to 70 percent slopes
CcA	Churn loam, 0 to 3 percent slopes
CcB	Churn loam, 3 to 8 percent slopes
CdA	Churn loam, slightly wet, 0 to 3 percent slopes
CeA	Churn gravelly loam, 0 to 3 percent slopes
CeB	Churn gravelly loam, 3 to 8 percent slopes
CfA	Churn gravelly loam, deep, 0 to 3 percent slopes
CfB	Churn gravelly loam, deep, 3 to 8 percent slopes
CgB	Clough gravelly loam, 3 to 8 percent slopes
Ch	Cobbly alluvial land
Ck	Cobbly alluvial land, frequently flooded
ClD	Cohasset loam, 0 to 30 percent slopes
CmD	Cohasset stony loam, 0 to 30 percent slopes
CmE	Cohasset stony loam, 30 to 50 percent slopes
CnF	Cohasset very stony loam, 50 to 70 percent slopes
CoE	Cohasset very stony loam, moderately deep, 8 to 50 percent slopes
CpD	Cohasset-Aiken stony loams, 0 to 30 percent slopes
CrD	Cohasset-McCarthy complex, 0 to 30 percent slopes
CrE	Cohasset-McCarthy complex, 30 to 50 percent slopes
CrG	Cohasset-McCarthy complex, 50 to 75 percent slopes
CsF	Colluvial land
CtC	Cone gravelly loam, 3 to 15 percent slopes
CtD	Cone gravelly loam, 15 to 30 percent slopes
CuD	Cone stony loam 3 to 30 percent slopes
CvF	Cone very stony loam 30 to 50 percent slopes
CwF	Cone very stony loam, moderately deep, 15 to 60 percent slopes
CxE	Corbett loamy coarse sand, 15 to 50 percent slopes
CxF3	Corbett loamy coarse sand, 30 to 70 percent slopes, severely eroded
CxG	Corbett loamy coarse sand, 50 to 80 percent slopes
CyG	Corbett very rocky loamy coarse sand, 30 to 80 percent slopes
DfD2	Diamond Springs very stony sandy loam, 8 to 30 percent slopes, eroded
DgE2	Diamond Springs very rocky sandy loam, 30 to 50 percent slopes, eroded
DgE3	Diamond Springs very rocky sandy loam, 30 to 50 percent slopes, severely eroded
FaD	Forward sandy loam, 5 to 30 percent slopes
FaE	Forward sandy loam, 30 to 50 percent slopes
FdD	Forward sandy loam, deep, 0 to 30 percent slopes
GaC	Gaviota fine sandy loam, 3 to 15 percent slopes
GaD	Gaviota fine sandy loam, 15 to 30 percent slopes
GbD	Gaviota very rocky sandy loam, 0 to 30 percent slopes
GbE2	Gaviota very rocky sandy loam, 30 to 50 percent slopes, eroded
GdD	Goulding very stony loam, 10 to 30 percent slopes
GeE2	Goulding very rocky loam, 30 to 50 percent slopes, eroded
GeF2	Goulding very rocky loam, 50 to 70 percent slopes, eroded
Gp	Gravel pits
GsD	Guenoc very stony loam, 0 to 30 percent slopes
GuD	Guenoc very rocky loam, 0 to 30 percent slopes
GuE	Guenoc very rocky loam, 30 to 50 percent slopes
HaF	Henneke very rocky loam, 15 to 60 percent slopes
Hb	Hillgate loam
HcE	Holland sandy loam, 15 to 50 percent slopes
HcF	Holland sandy loam, 50 to 70 percent slopes
Hd	Honcut loam
He	Honcut gravelly loam
Hf	Honcut gravelly loam, deep
HgA	Honn fine sandy loam, 0 to 3 percent slopes
HgB	Honn fine sandy loam, 3 to 8 percent slopes
HhA	Honn gravelly sandy loam, 0 to 3 percent slopes
IaB	Igo gravelly loam, 0 to 8 percent slopes
IbD	Inks gravelly loam, 8 to 30 percent slopes
IdD	Inks very stony loam, 3 to 30 percent slopes
IdE	Inks very stony loam, 30 to 50 percent slopes
IeD	Inks-Pentz complex, 5 to 30 percent slopes
IeE	Inks-Pentz complex, 30 to 50 percent slopes
JbD	Josephine gravelly loam, 10 to 30 percent slopes
JbE	Josephine gravelly loam, 30 to 50 percent slopes
JbF	Josephine gravelly loam, 50 to 70 percent slopes
JdD	Josephine gravelly loam, moderately deep, 10 to 30 percent slopes
JdE	Josephine gravelly loam, moderately deep, 30 to 50 percent slopes
JsF	Josephine-Sheetiron complex, 50 to 70 percent slopes
KbC	Kanaka sandy loam, 3 to 15 percent slopes
KcD	Kanaka rocky sandy loam, 5 to 30 percent slopes
KcE	Kanaka rocky sandy loam, 30 to 50 percent slopes
KcF2	Kanaka rocky sandy loam, 50 to 70 percent slopes, eroded
KdA	Keefers gravelly loam, 0 to 3 percent slopes
KdB	Keefers gravelly loam, 3 to 8 percent slopes
KeB	Keefers cobbly loam, channeled, 1 to 5 percent slopes
KgF2	Kidd very rocky loam, 10 to 60 percent slopes, eroded
KhC	Kilarc sandy clay loam, 2 to 15 percent slopes
KhD	Kilarc sandy clay loam, 15 to 30 percent slopes
KhE	Kilarc sandy clay loam, 30 to 50 percent slopes
KlD	Kilarc very stony sandy clay loam, 10 to 30 percent slopes
KlE	Kilarc very stony sandy clay loam, 30 to 50 percent slopes
KsD	Kilarc Sites complex, 8 to 30 percent slopes
LaE	Landslides
LbE	Lodo shaly loam, 10 to 50 percent slopes
LbF3	Lodo shaly loam, 50 to 70 percent slopes, severely eroded
LcA	Los Robles loam, 0 to 3 percent slopes
LcB	Los Robles loam, 3 to 8 percent slopes
LdA	Los Robles loam, seeped, 0 to 3 percent slopes
LeB	Los Robles loam, moderately deep, 0 to 5 percent slopes
LfA	Los Robles gravelly loam, 0 to 3 percent slopes
LgE	Lyonsville-Jiggs complex, 10 to 50 percent slopes
LhE	Lyonsville-Jiggs complex, deep, 10 to 50 percent slopes
LkF	Lyonsville and Jiggs soils, 50 to 70 percent slopes
MaE	Marpa gravelly loam, 30 to 50 percent slopes
MaG	Marpa gravelly loam, 50 to 75 percent slopes
MbG2	Maymen very stony loam, 30 to 80 percent slopes, eroded
McD	Millsap loam, 5 to 30 percent slopes
McE	Millsap loam, 30 to 50 percent slopes
McG	Millsap loam, 50 to 75 percent slopes
MdE	Millsap very rocky loam, 10 to 50 percent slopes
MeD	Millsholm gravelly loam, 3 to 30 percent slopes
MeD2	Millsholm gravelly loam, 3 to 30 percent slopes, eroded
MeE	Millsholm gravelly loam, 30 to 50 percent slopes
MeG	Millsholm gravelly loam, 50 to 75 percent slopes
MfE2	Millsholm very rocky loam, 30 to 50 percent slopes, eroded
MfF2	Millsholm very rocky loam, 50 to 70 percent slopes, eroded
MgA	Moda loam, 0 to 3 percent slopes
MhA	Moda loam, seeped, 0 to 3 percent slopes
MkB	Moda loam, shallow, 0 to 5 percent slopes
Mm	Molinos sandy loam, channeled
Mn	Molinos fine sandy loam
Mo	Molinos fine sandy loam, seeped
MrA	Myers silty clay, 0 to 3 percent slopes
MrB	Myers silty clay, 3 to 8 percent slopes
NaB	Nanny gravelly sandy loam, 0 to 8 percent slopes
NbB	Nanny stony sandy loam, 0 to 8 percent slopes
NcB	Nanny-Windy complex, 0 to 8 percent slopes
NdE	Neuns very stony loam, 8 to 50 percent slopes
NdG	Neuns very stony loam, 50 to 80 percent slopes
NeC	Newtown gravelly loam, 8 to 15 percent slopes
NeD	Newtown gravelly loam, 15 to 30 percent slopes
NeE2	Newtown gravelly loam, 30 to 50 percent slopes, eroded
NfE2	Newtown stony loam, 8 to 50 percent slopes, eroded
PcD	Parrish loam, 8 to 30 percent slopes
PcE	Parrish loam, 30 to 50 percent slopes
PcF	Parrish loam, 50 to 70 percent slopes
PfF	Pentz-Supan complex, 50 to 70 percent slopes
PlA	Perkins loam, 0 to 3 percent slopes
PmA	Perkins gravelly loam, 0 to 3 percent slopes
PmB	Perkins gravelly loam, 3 to 8 percent slopes
PmC	Perkins gravelly loam, 8 to 15 percent slopes
PmD	Perkins gravelly loam, 15 to 30 percent slopes
PnA	Perkins gravelly loam, seeped, 0 to 3 percent slopes
PoA	Perkins gravelly loam, moderately deep, 0 to 3 percent slopes
PoB	Perkins gravelly loam, moderately deep, 3 to 8 percent slopes
RbA	Red Bluff loam, 0 to 3 percent slopes
RbB	Red Bluff loam, 3 to 8 percent slopes
RcA	Red Bluff gravelly loam, moderately deep, 0 to 3 percent slopes
RcB	Red Bluff gravelly loam, moderately deep, 3 to 8 percent slopes
RdA	Redding gravelly loam, 0 to 3 percent slopes
RdB	Redding gravelly loam, 3 to 8 percent slopes
ReA	Redding-Red Bluff gravelly loams, 0 to 3 percent slopes
ReB	Redding-Red Bluff gravelly loams, 3 to 8 percent slopes
RfB	Reiff sandy loam, channeled, 0 to 8 percent slopes
RgA	Reiff fine sandy loam, 0 to 3 percent slopes
RgB	Reiff fine sandy loam, 3 to 8 percent slopes
RhA	Reiff fine sandy loam, deep 0 to 3 percent slopes
RkA	Reiff gravelly fine sandy loam, deep, 0 to 3 percent slopes
RlA	Reiff loam, 0 to 3 percent slopes
RmA	Reiff loam, seeped, 0 to 3 percent slopes
RnA	Reiff gravelly loam, 0 to 3 percent slopes
RoA	Reiff gravelly loam, slightly wet, 0 to 3 percent slopes
Rw	Riverwash
RxF	Rock land
RyF	Rubble land
ScB	Sehorn silty clay, 3 to 8 percent slopes
ScD	Sehorn silty clay, 8 to 30 percent slopes
ScE	Sehorn silty clay, 30 to 50 percent slopes
SdD2	Sehorn very stony silty clay, 8 to 30 percent slopes, eroded
SeD	Sehorn silty clay, moderately deep, 8 to 30 percent slopes
SeE	Sehorn silty clay, moderately deep, 30 to 50 percent slopes
SfF2	Sehorn complex, 50 to 70 percent slopes, eroded
SgE	Sheetiron very stony loam, 30 to 50 percent slopes
SgF	Sheetiron very stony loam, 50 to 75 percent slopes
SgG	Sheetiron very stony loam, 75 to 90 percent slopes
ShB	Shingletown clay loam, 0 to 8 percent slopes
SkA	Shingletown loam, drained, 0 to 3 percent slopes
SmB	Sierra sandy loam, 3 to 8 percent slopes
SmC	Sierra sandy loam, 8 to 15 percent slopes
SmD	Sierra sandy loam, 15 to 30 percent slopes
SmD3	Sierra sandy loam, 15 to 30 percent slopes, severely eroded
SmE	Sierra sandy loam, 30 to 50 percent slopes
SnC	Sites loam, 5 to 15 percent slopes
SnD	Sites loam, 15 to 30 percent slopes
SnE	Sites loam, 30 to 50 percent slopes
SnF	Sites loam, 50 to 70 percent slopes
SoD	Sites stony loam, 8 to 30 percent slopes
SpE	Sites very rocky loam, 30 to 50 percent slopes
SrA	Spreckels sandy loam, 0 to 3 percent slopes
SrB	Spreckels sandy loam, 3 to 8 percent slopes
SsE	Stonyford very stony loam, 30 to 50 percent slopes
SsG	Stonyford very stony loam, 50 to 75 percent slopes
StC	Supan gravelly loam, 5 to 15 percent slopes
StD	Supan gravelly loam, 15 to 30 percent slopes
StE	Supan gravelly loam, 30 to 50 percent slopes
SuD	Supan very stony loam, 0 to 30 percent slopes
SuE	Supan very stony loam, 30 to 50 percent slopes
TaD	Tailings and Placer diggings
TbA	Tehama loam, 0 to 3 percent slopes
TbB	Tehama loam, 3 to 8 percent slopes
TbC	Tehama loam, 8 to 15 percent slopes
TcE	Toomes very rocky loam, 0 to 50 percent slopes
TeD	Toomes very stony loam, 0 to 30 percent slopes
TfA	Tujunga loamy sand, 0 to 3 percent slopes
TfB	Tujunga loamy sand, 3 tp 8 percent slopes
ThA	Tuscan cobbly loam, 0 to 3 percent slopes
ThB	Tuscan cobbly loam, 3 to 8 percent slopes
VeA	Vina loam, 0 to 3 percent slopes
VfA	Vina loam, seeped, 0 to 3 percent slopes
VgB	Vina gravelly loam, 3 to 8 percent slopes
Wa	wet alluvial land
WeD	Windy and McCarthy stony sandy loams, 0 to 30 percent slopes
WfE	Windy and McCarthy very stony sandy loams, 30 to 50 percent slopes
WfG	Windy and McCarthy very stony sandy loams, 50 to 75 percent slopes
WgE	Windy and McCarthy very rocky sandy loams, 8 to 50 percent slopes

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Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

(2)

N

Scale 1:20 000

1 Mile ¾ ½ ¼ 0

5 000 Feet 4 000 3 000 2 000 1 000 0

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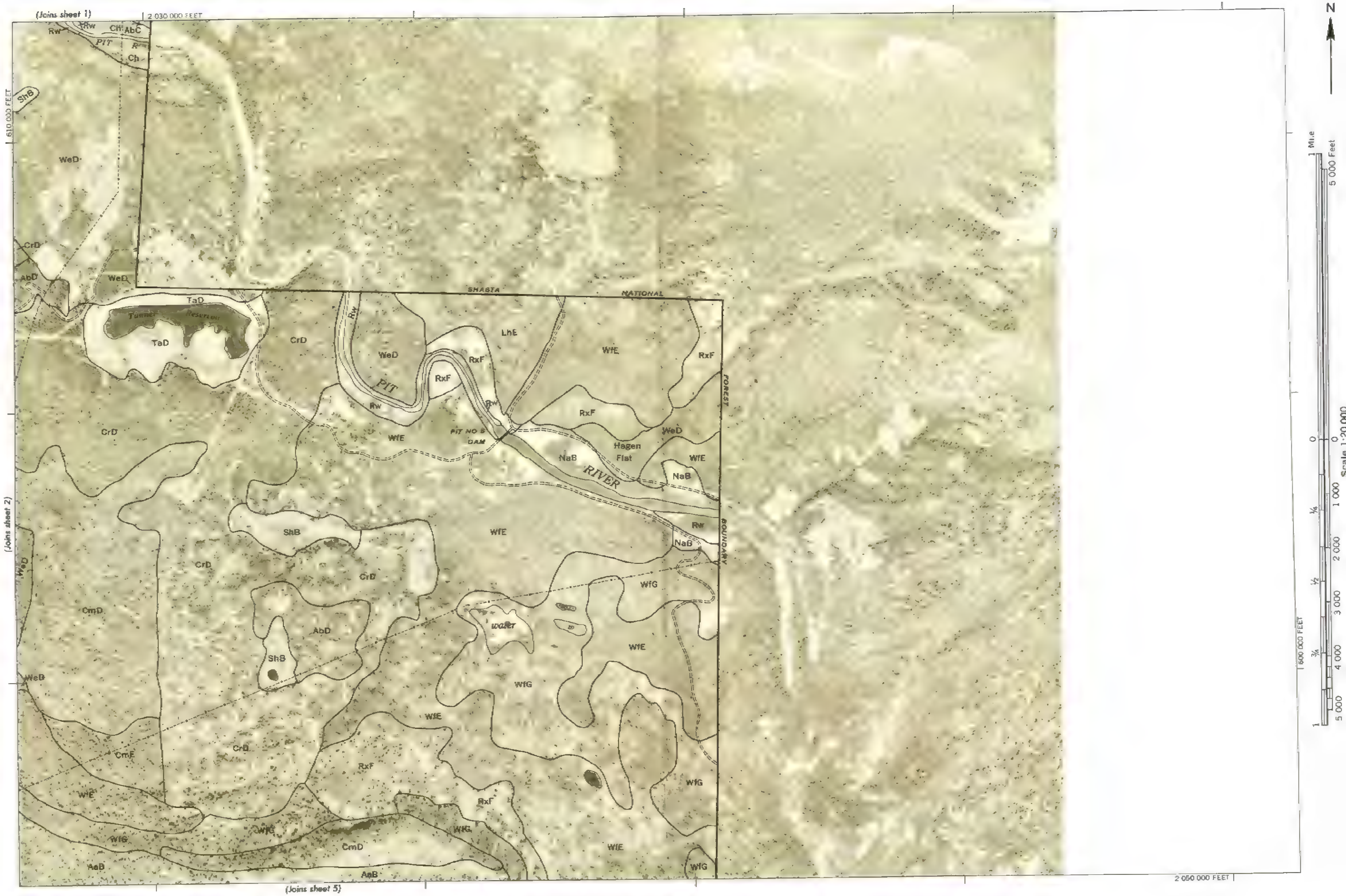

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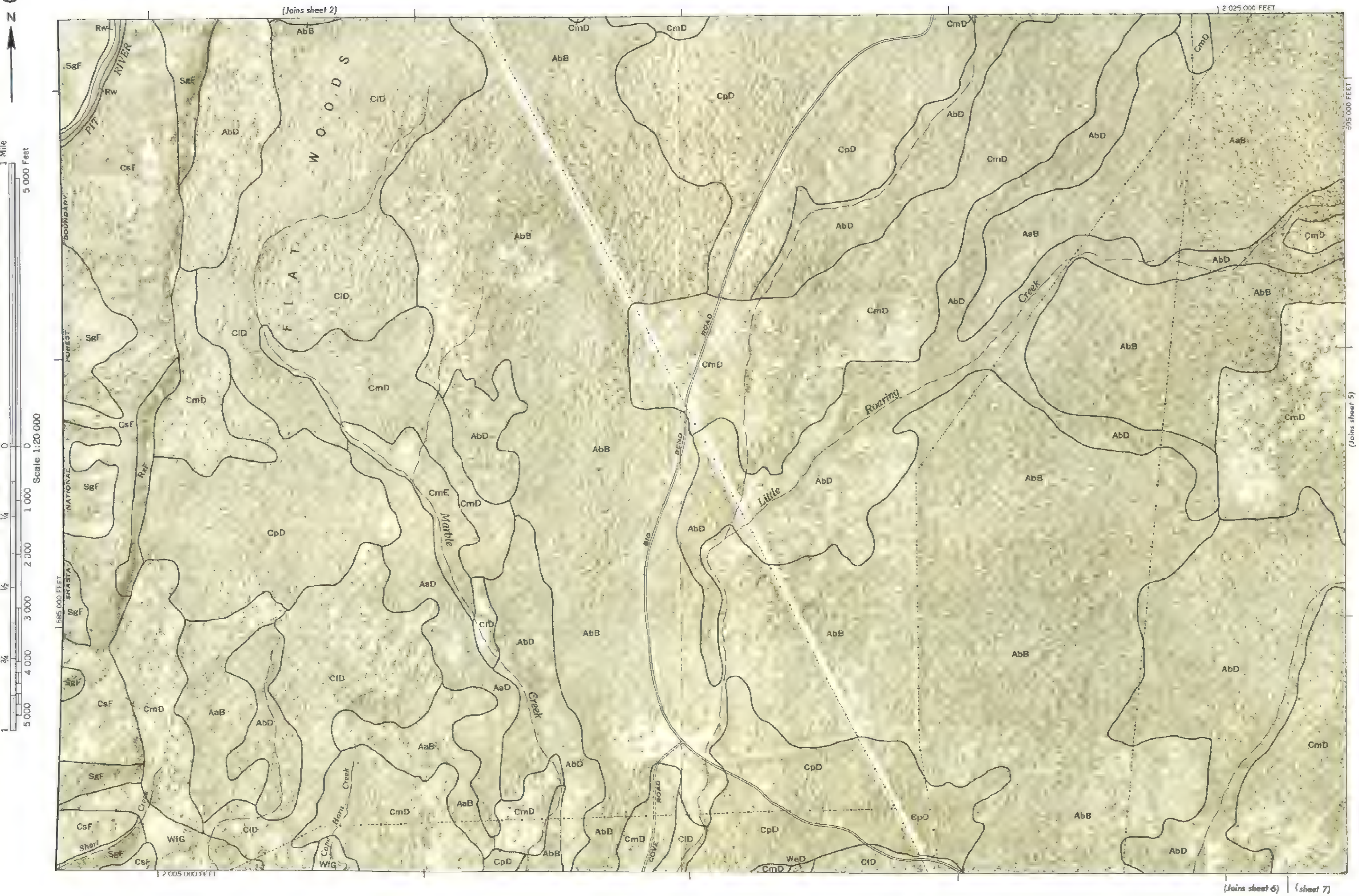

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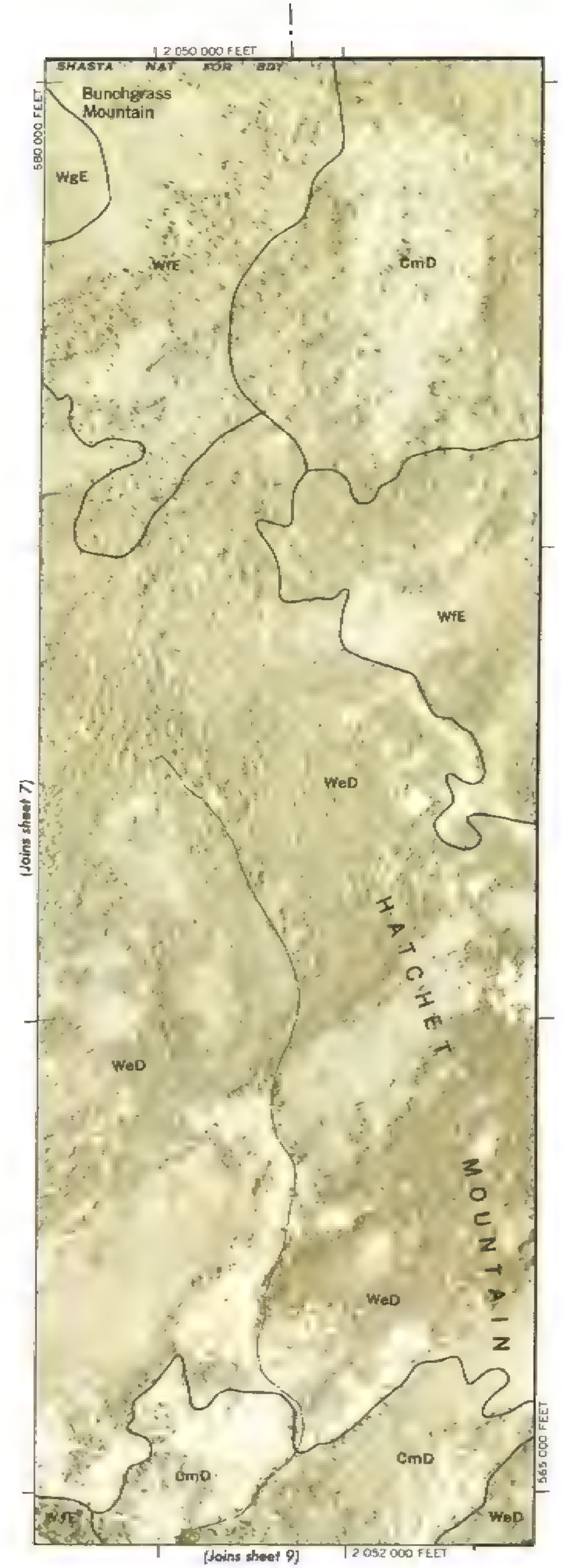

2 000 AND 5 000-FOOT GRID TICKS

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SHASTA AREA, CALIFORNIA — SHEET NUMBER 8

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9

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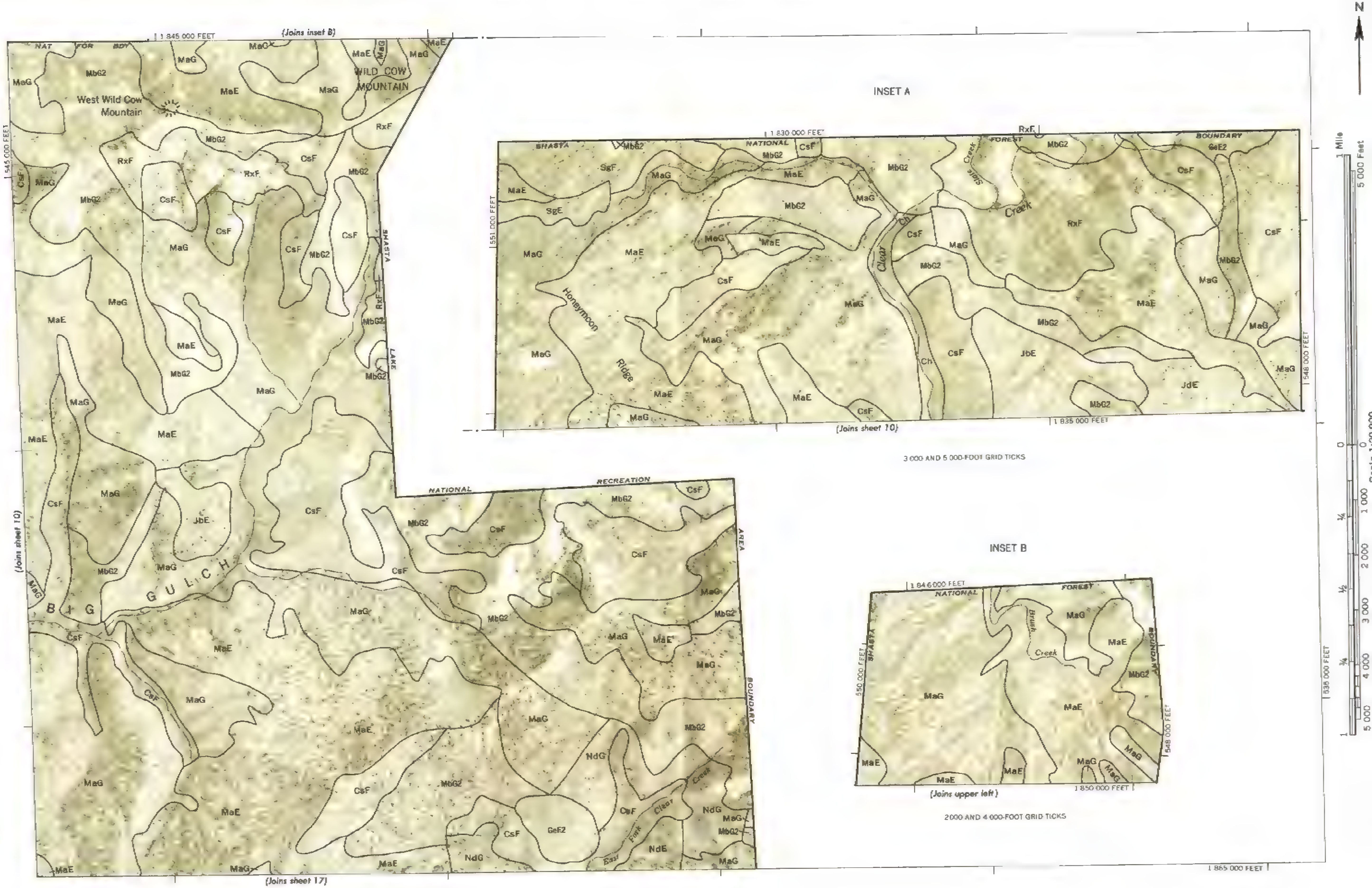

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SHASTA AREA, CALIFORNIA NO. 13
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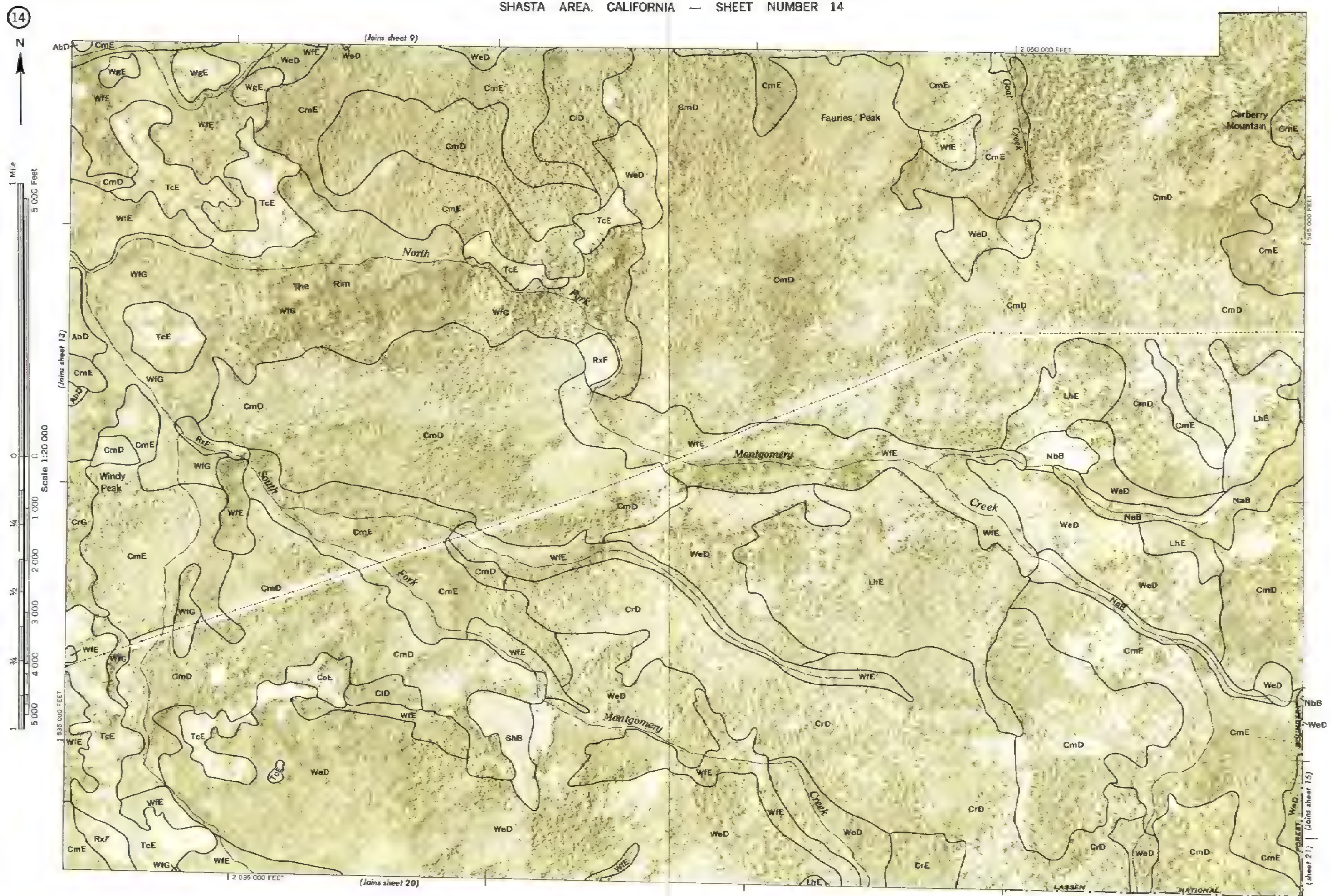
Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.



Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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SHASTA AREA, CALIFORNIA NO. 14

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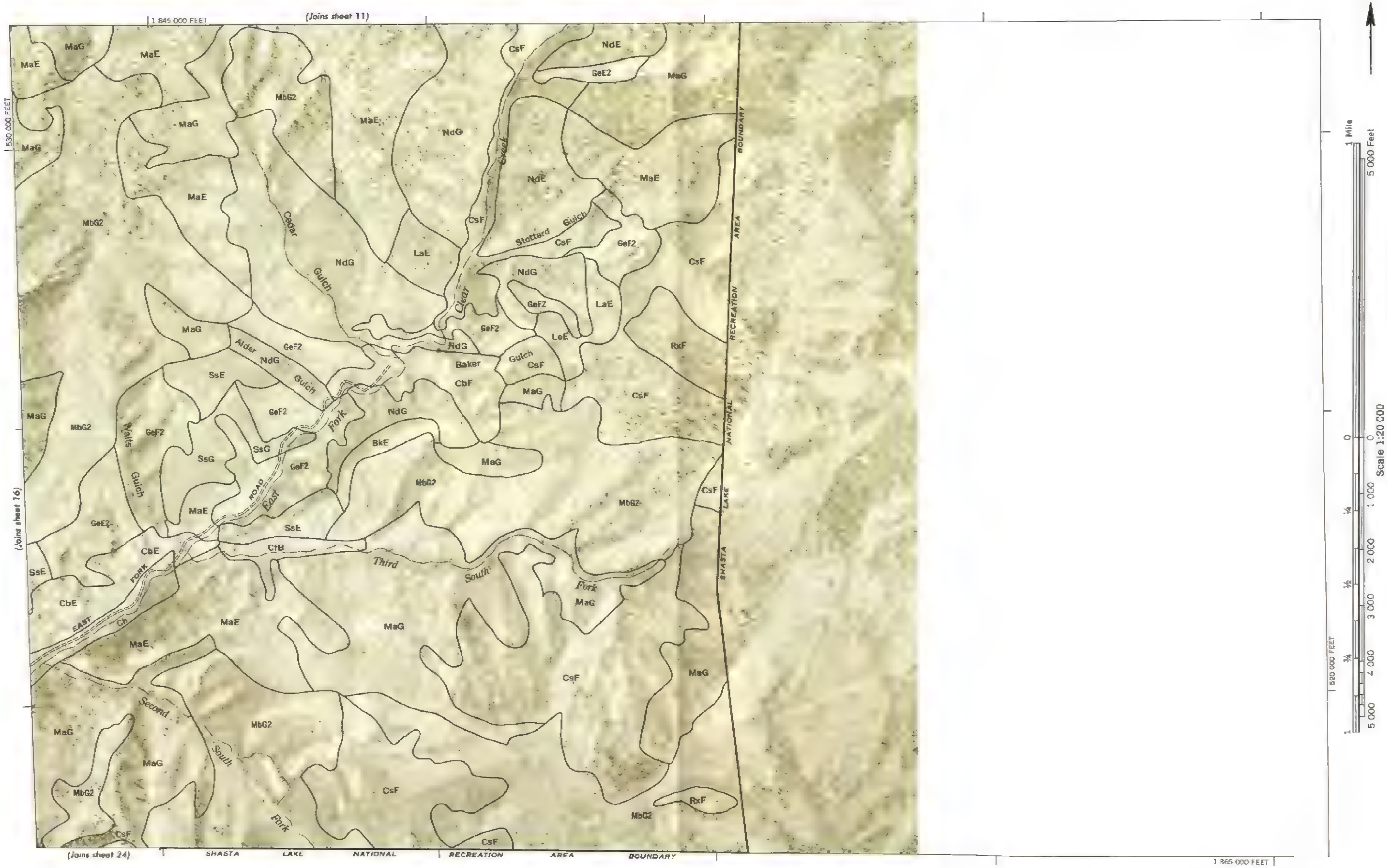

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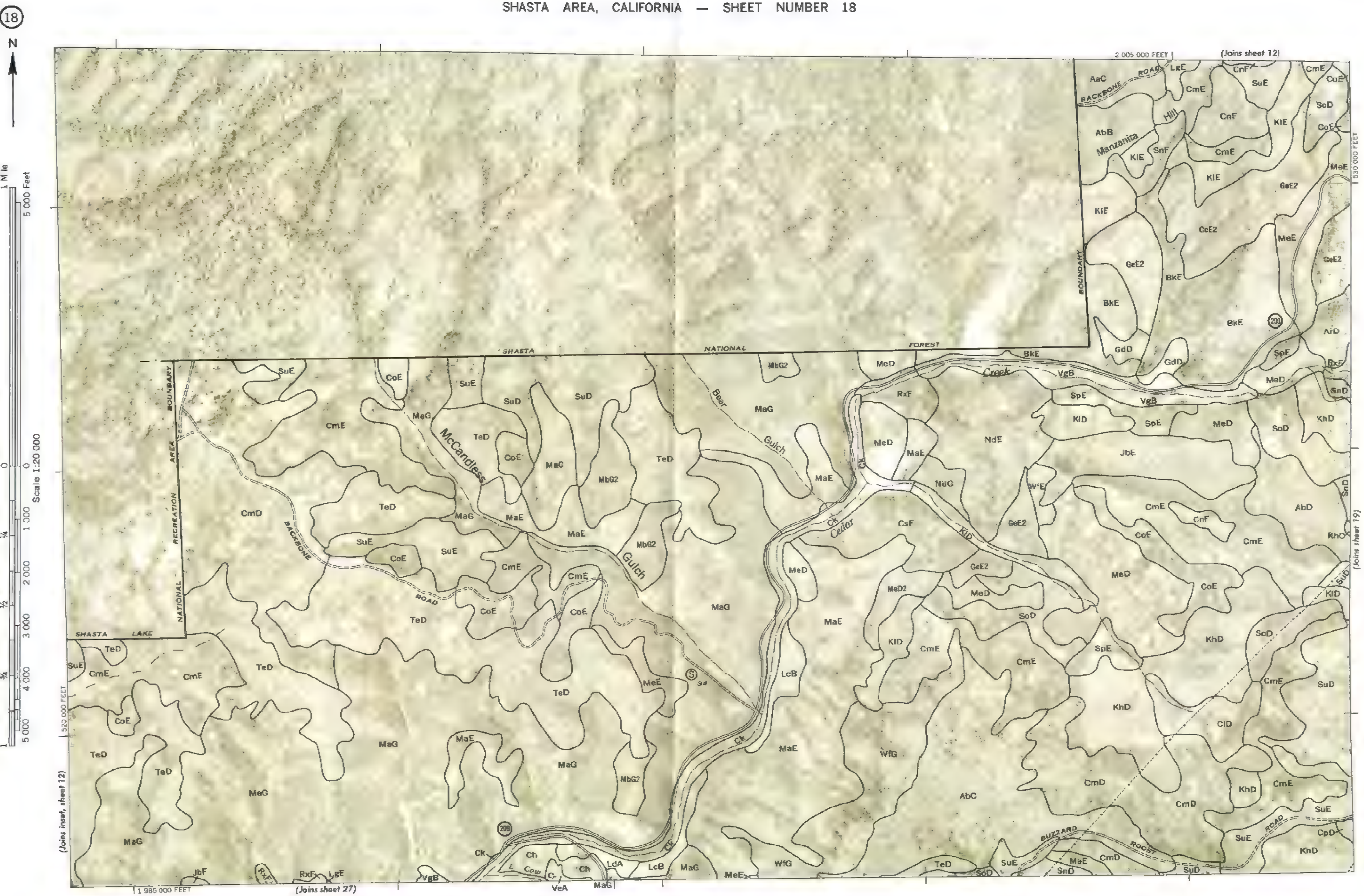

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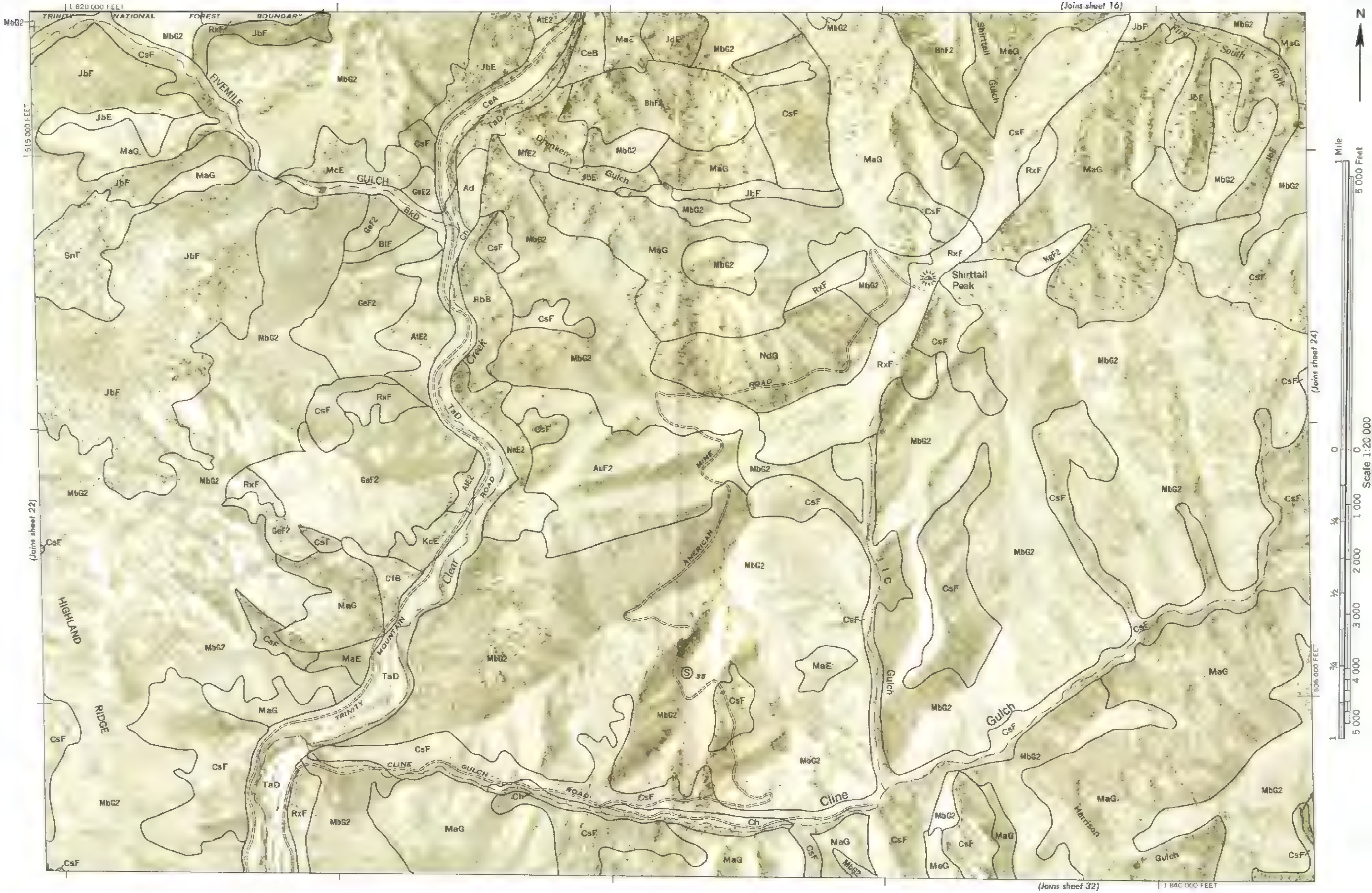

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SHASTA AREA, CALIFORNIA NO. 24

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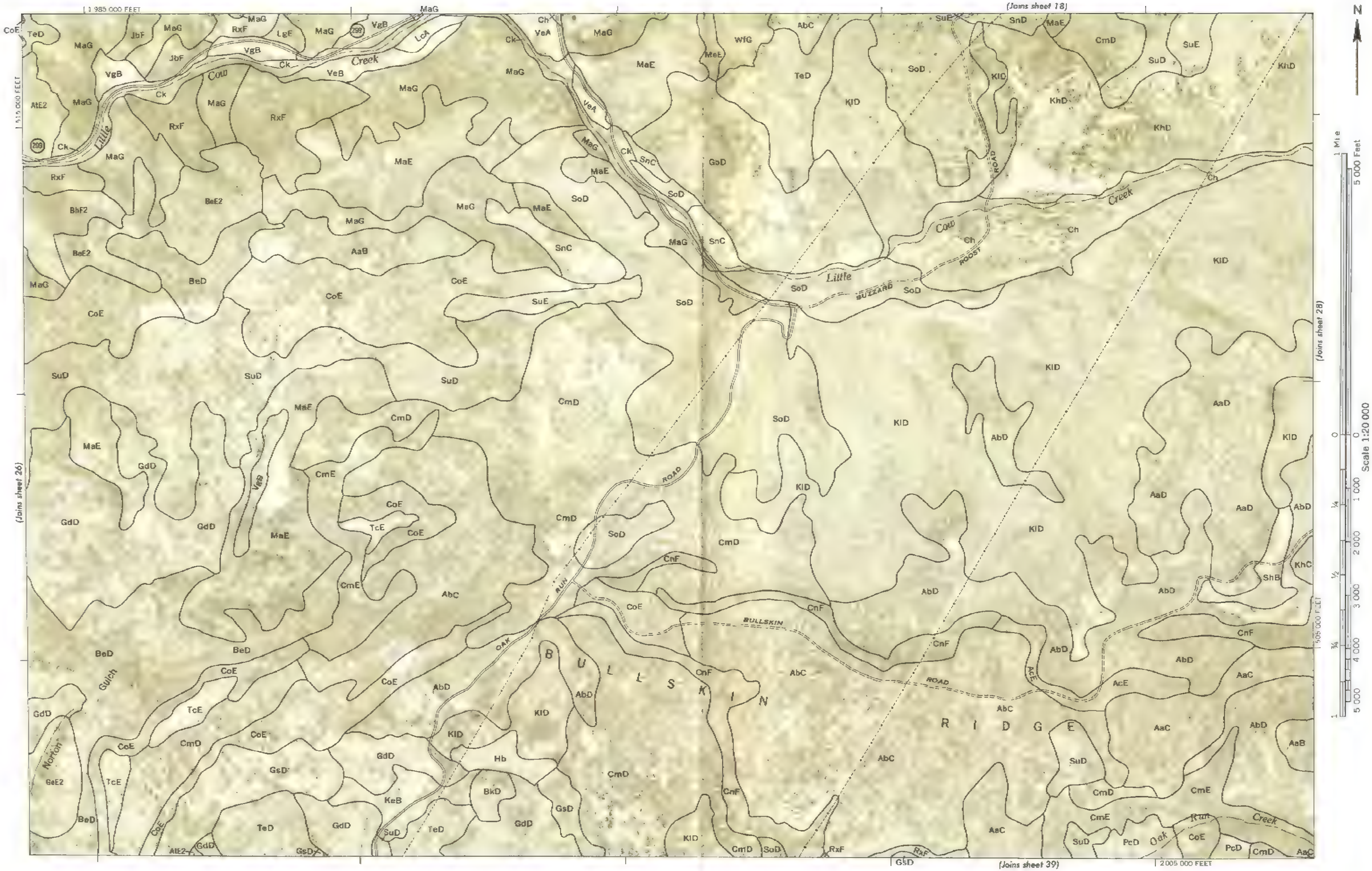
(Joins sheet 18)
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(Joins sheet 28)
(Joins sheet 39)
1 985 000 FEET
515 000 FEET
505 000 FEET
2 005 000 FEET
N
Scale 1:20 000
1 Mile
5 000 Feet
Little Cow Creek
Cow Creek
BUZZARD ROOST ROAD
OAK RUN ROAD
BULLSKIN ROAD
ACE
BULLSKIN RIDGE
Gulch
Norton
Oak Run Creek
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Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1

28

Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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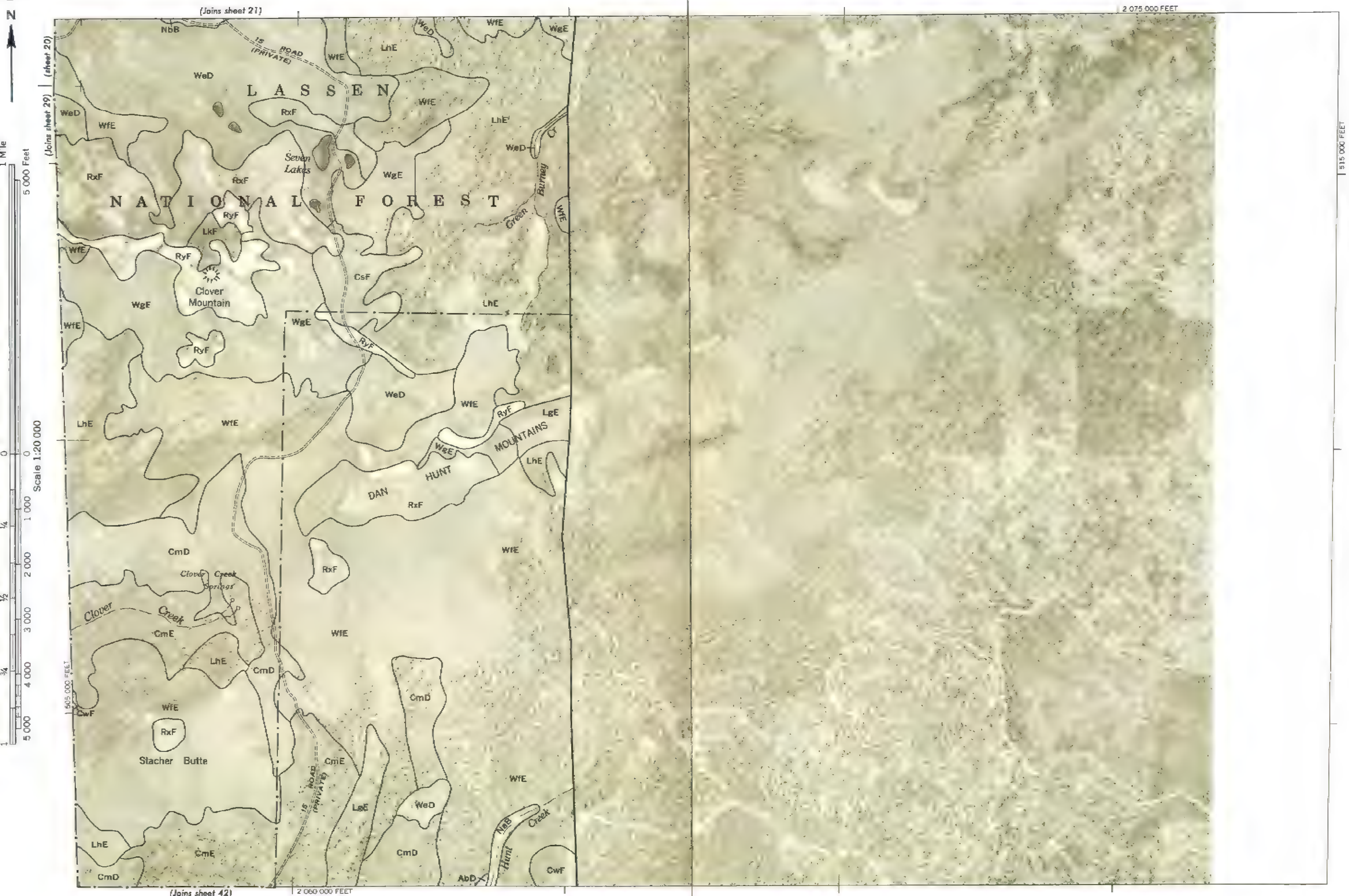

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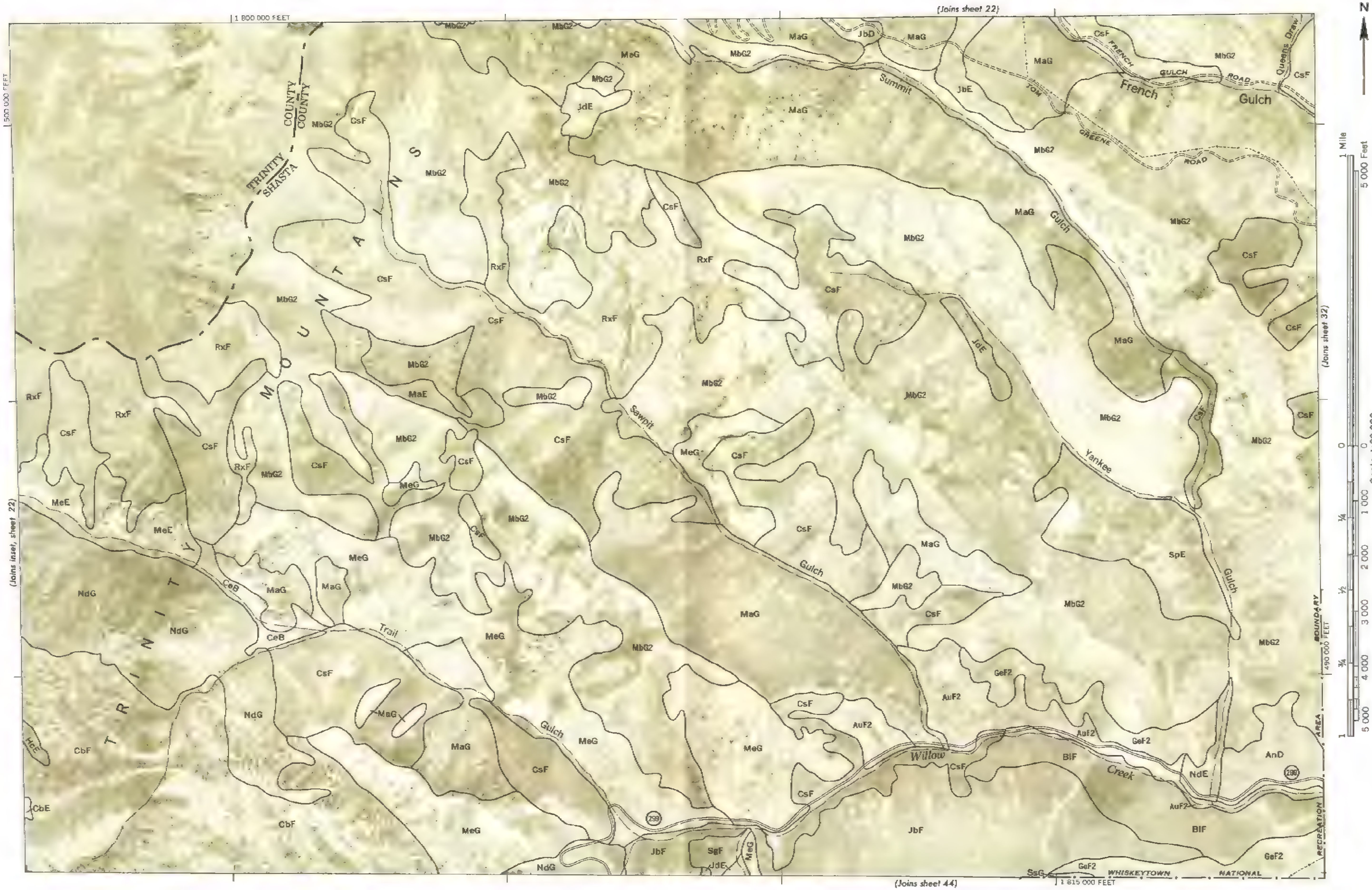

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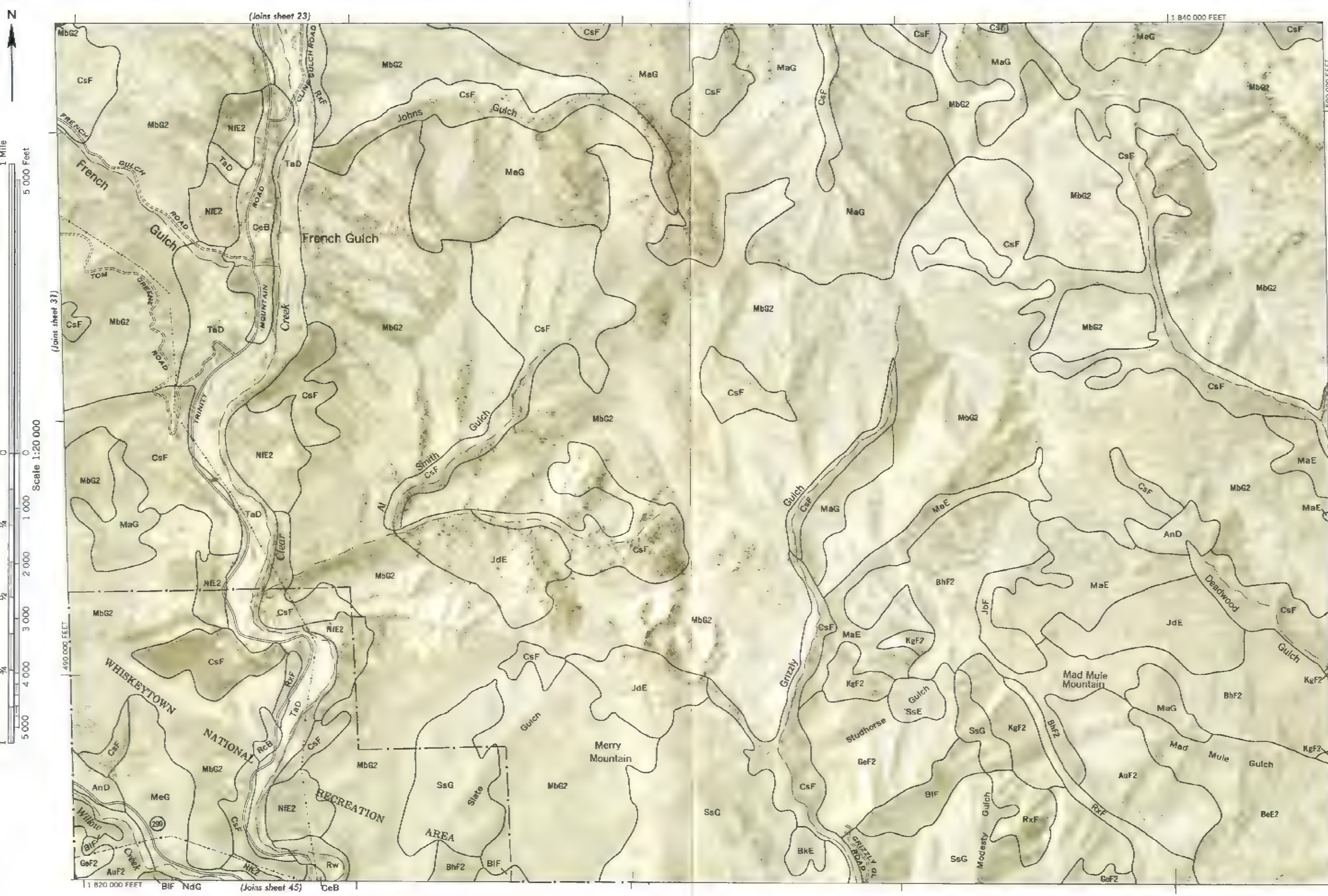

Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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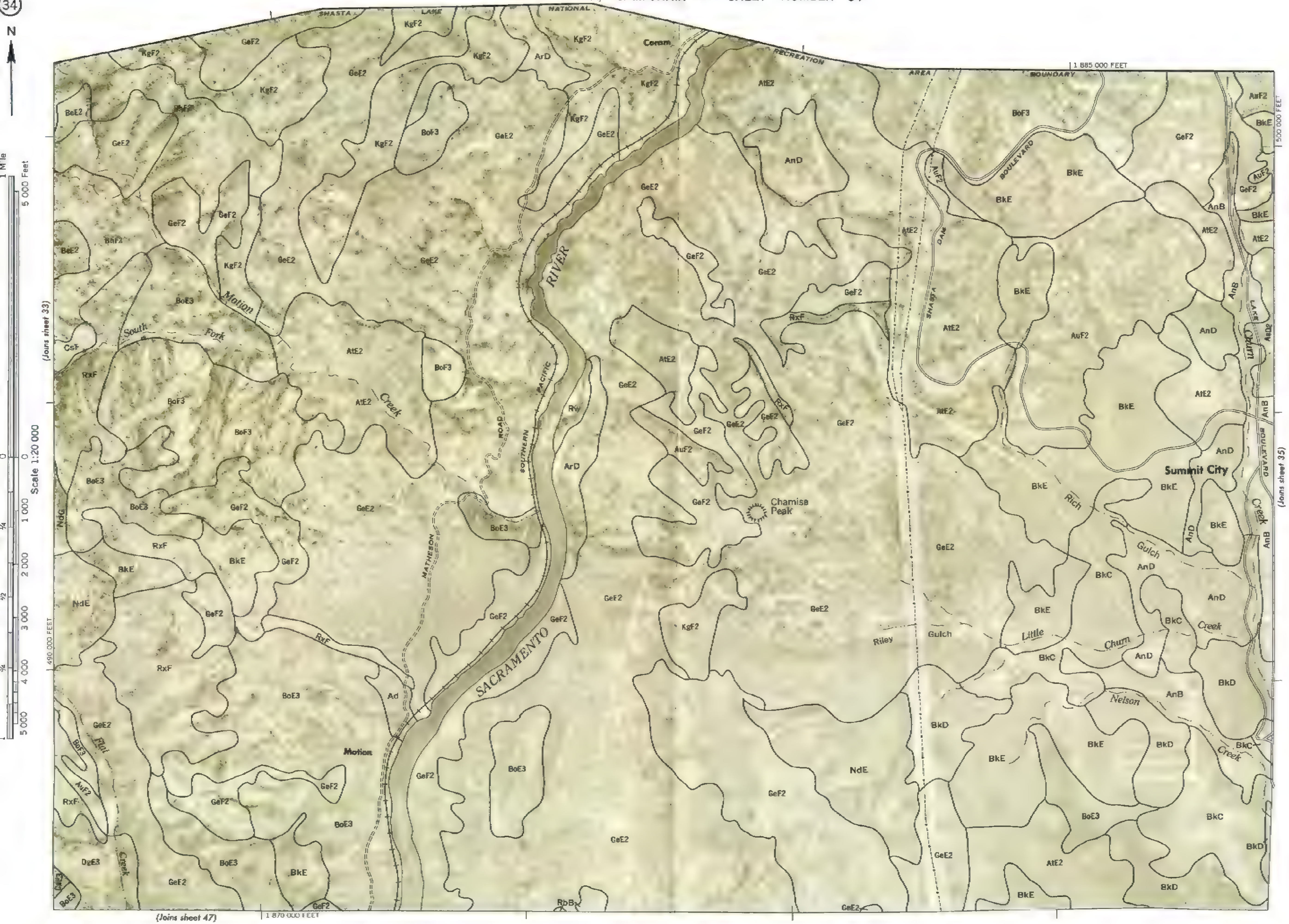

Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.

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Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
Land division corners are approximately positioned on this map.

Land division corners are approximately positioned on this map

Photobase from 1952 and 1953 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station

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Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1

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39

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

40

N

1 Mile 5 000 Feet

0 0

Scale 1:20 000

¼ 1 000

2 000

½ 3 000

¾ 4 000

1 5 000

Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station

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Photobase from 1952 and 1963 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the California coordinate system, zone I

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Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

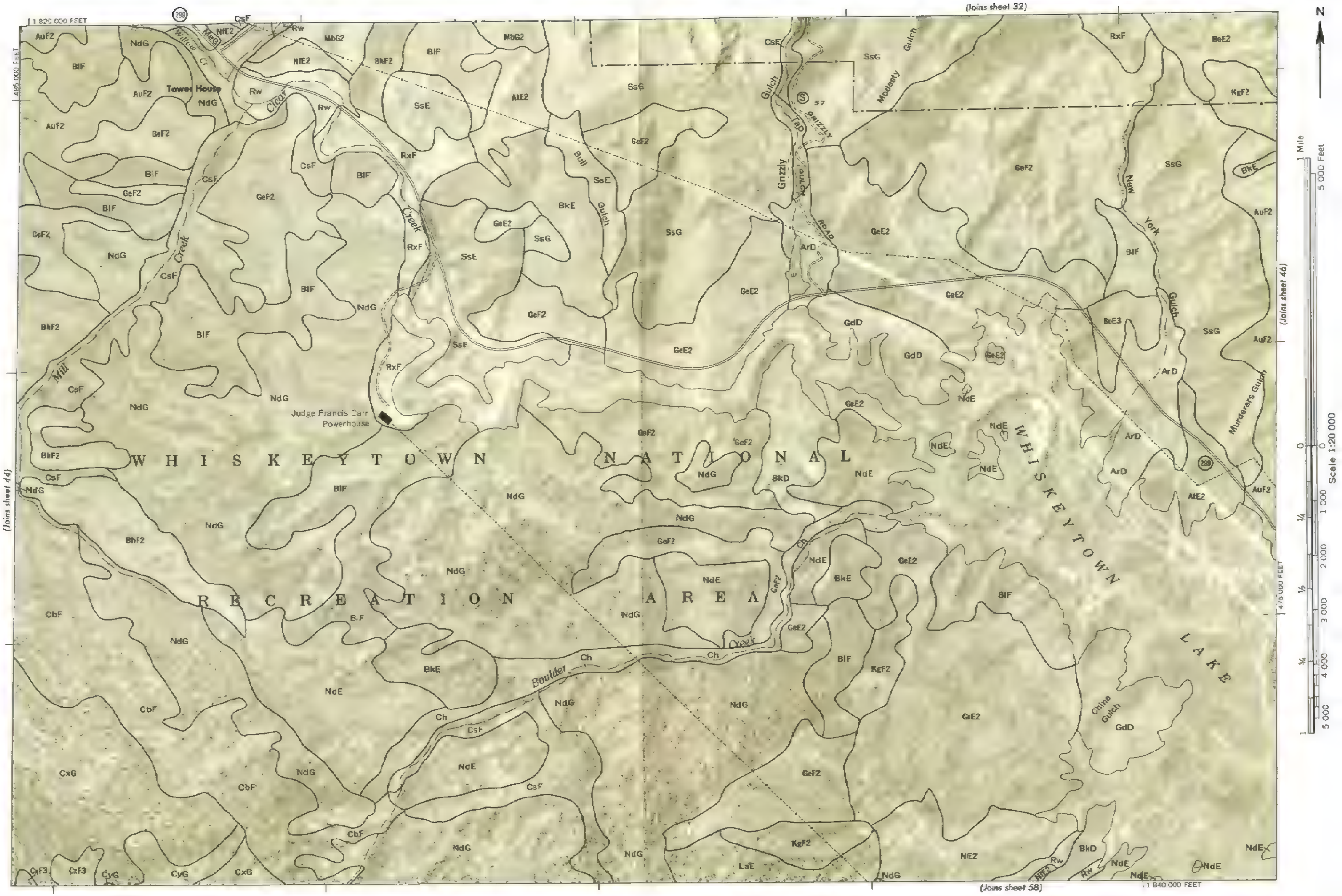
44

N

Scale 1:20 000

Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

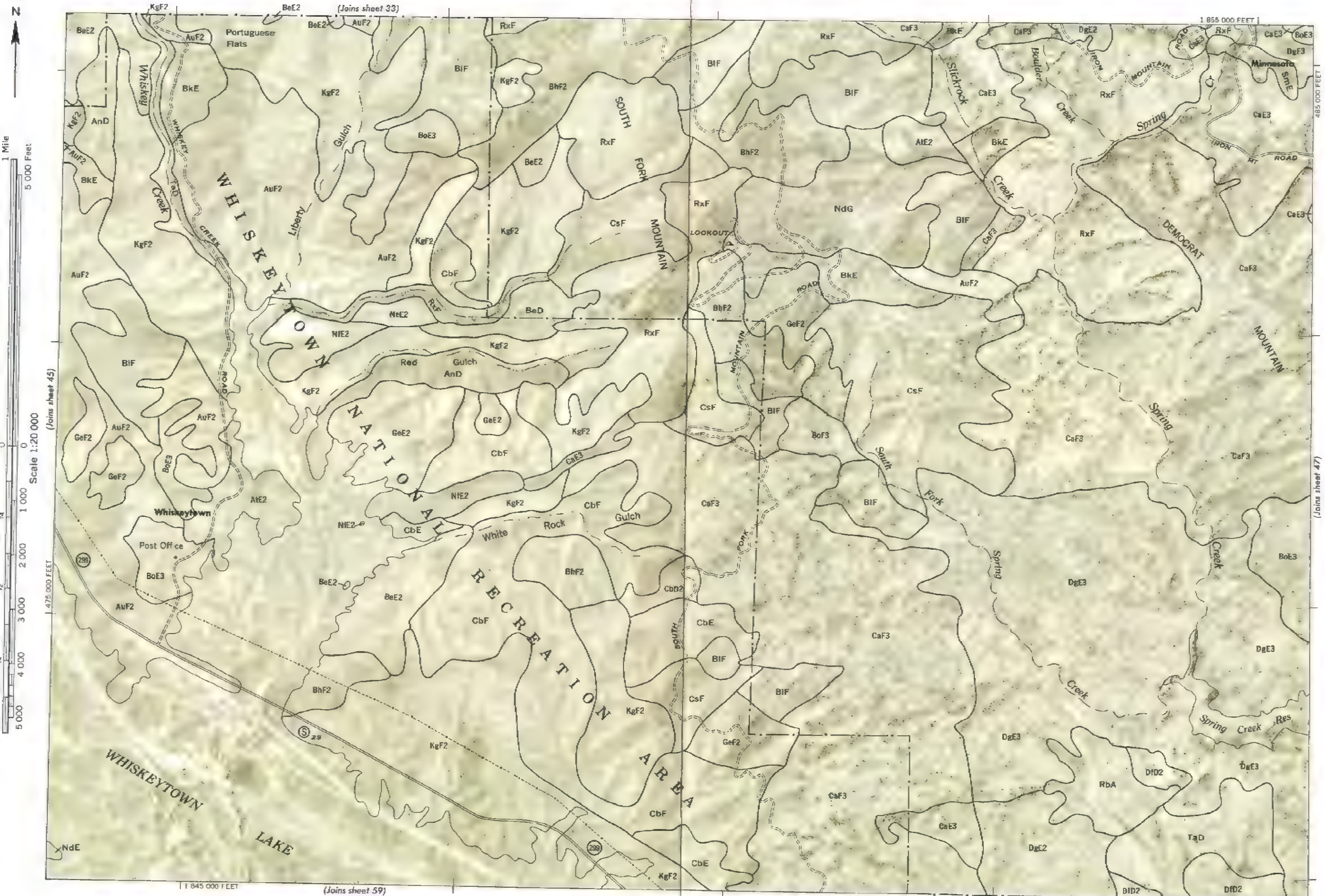
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.



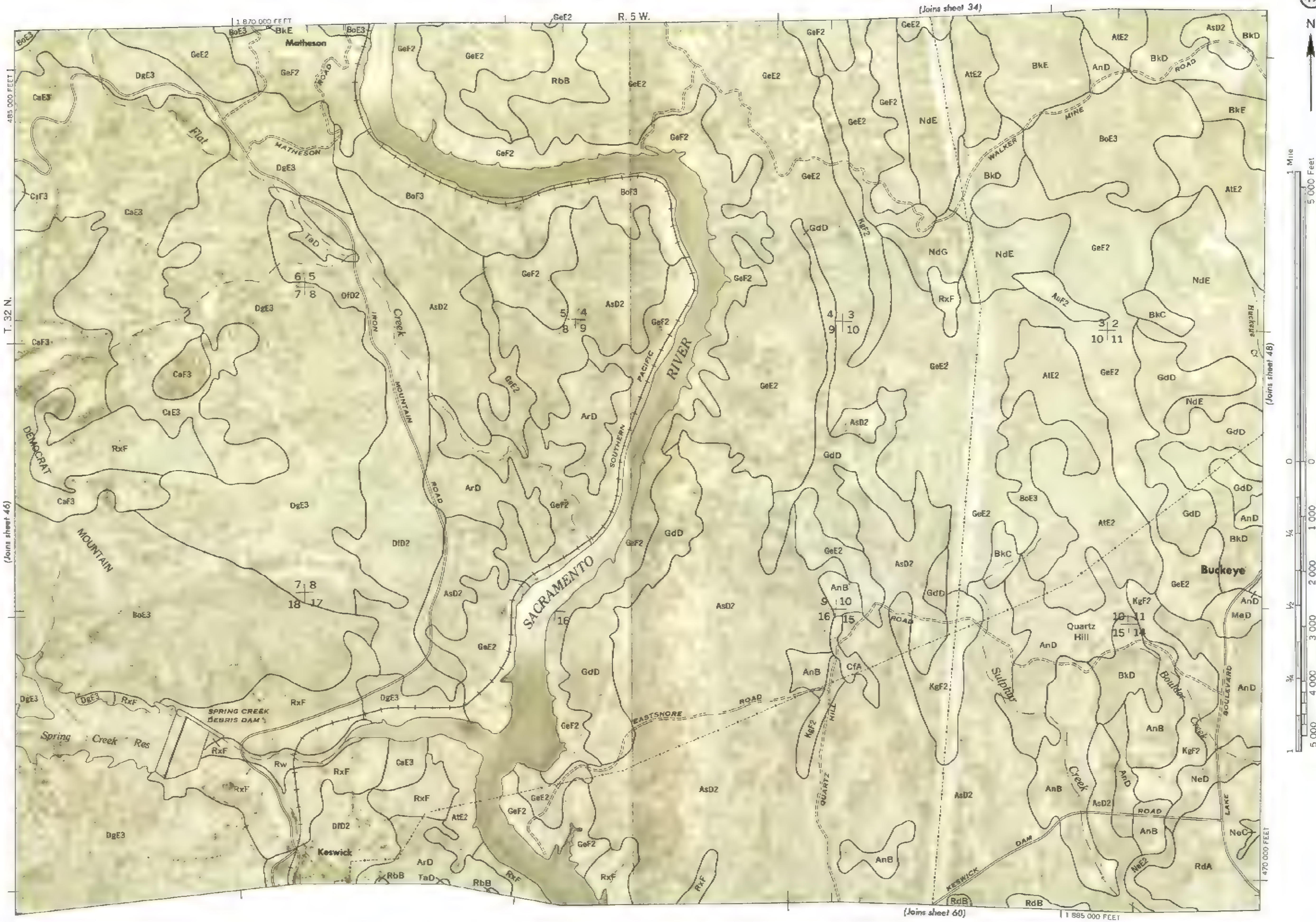
SHASTA AREA, CALIFORNIA NO. 45

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.

Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
Land division corners are approximately positioned on this map.

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Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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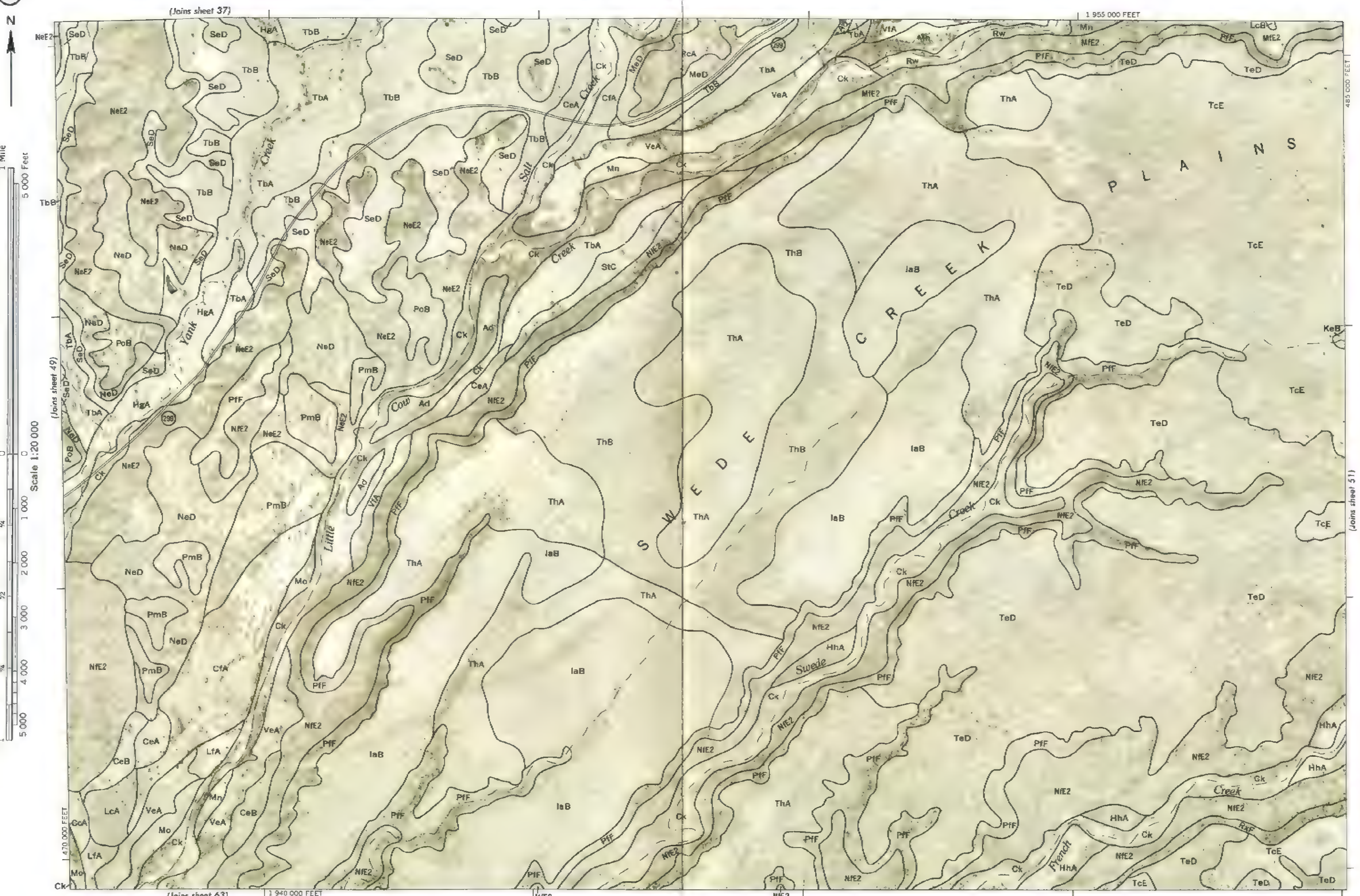

Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.

51

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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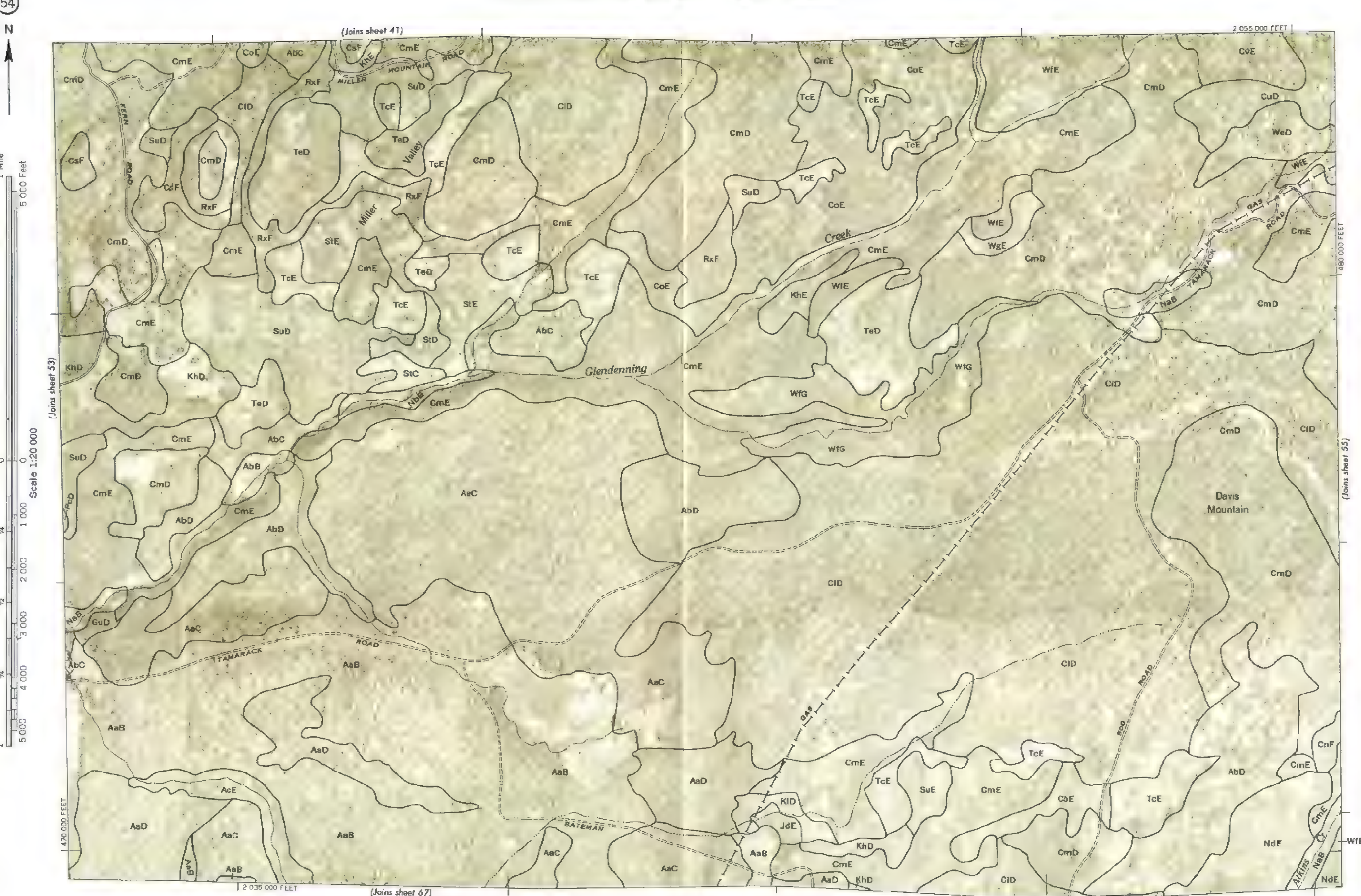
SHASTA AREA, CALIFORNIA NO. 52

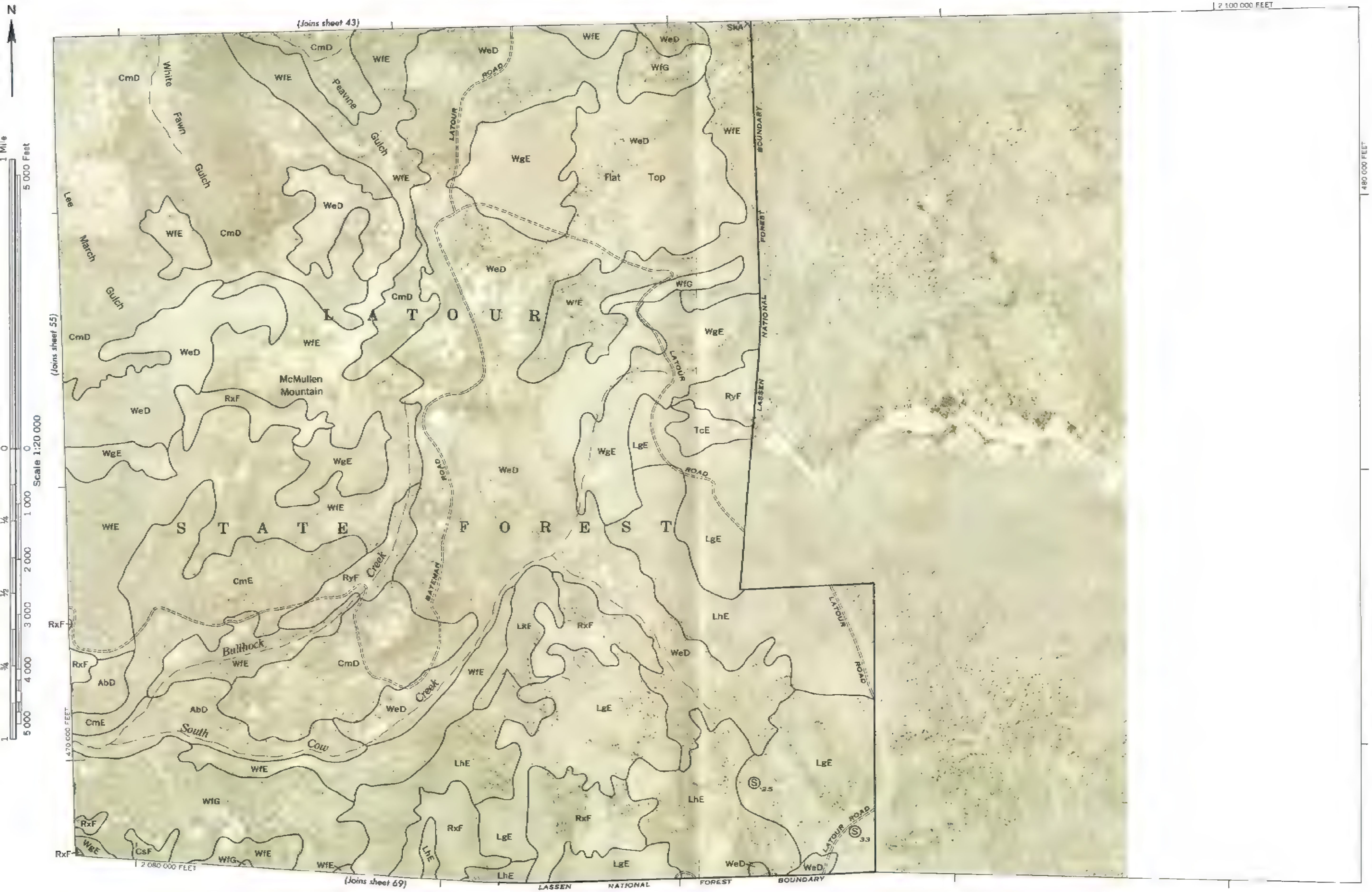
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.

Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.



Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
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59

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

Land divisions corners are approximately positioned on this map.
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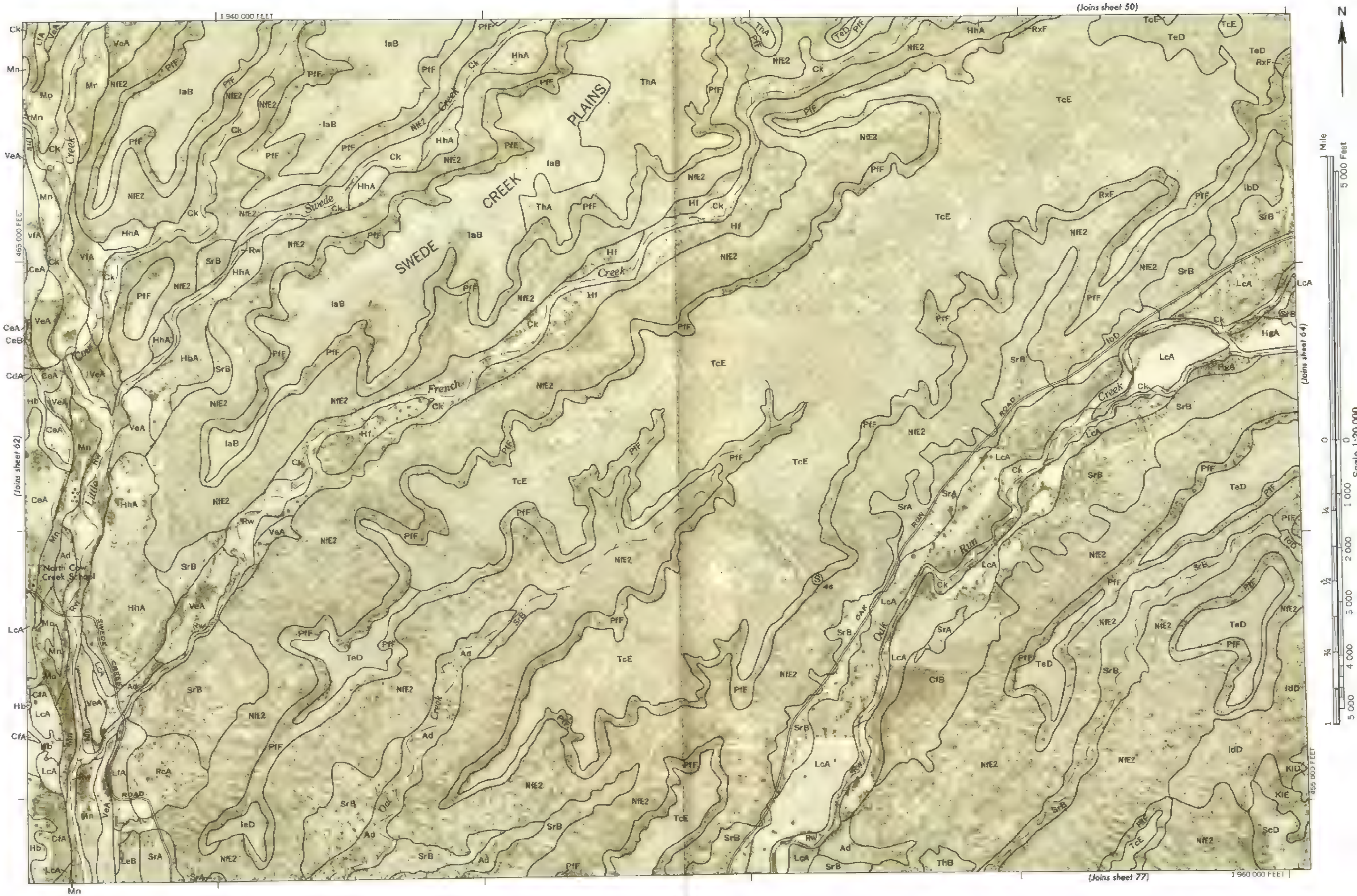
Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
Land division corners are approximately positioned on this map.

SHASTA AREA, CALIFORNIA — SHEET NUMBER 62

Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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Photobase from 1952 and 1953 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1

68

Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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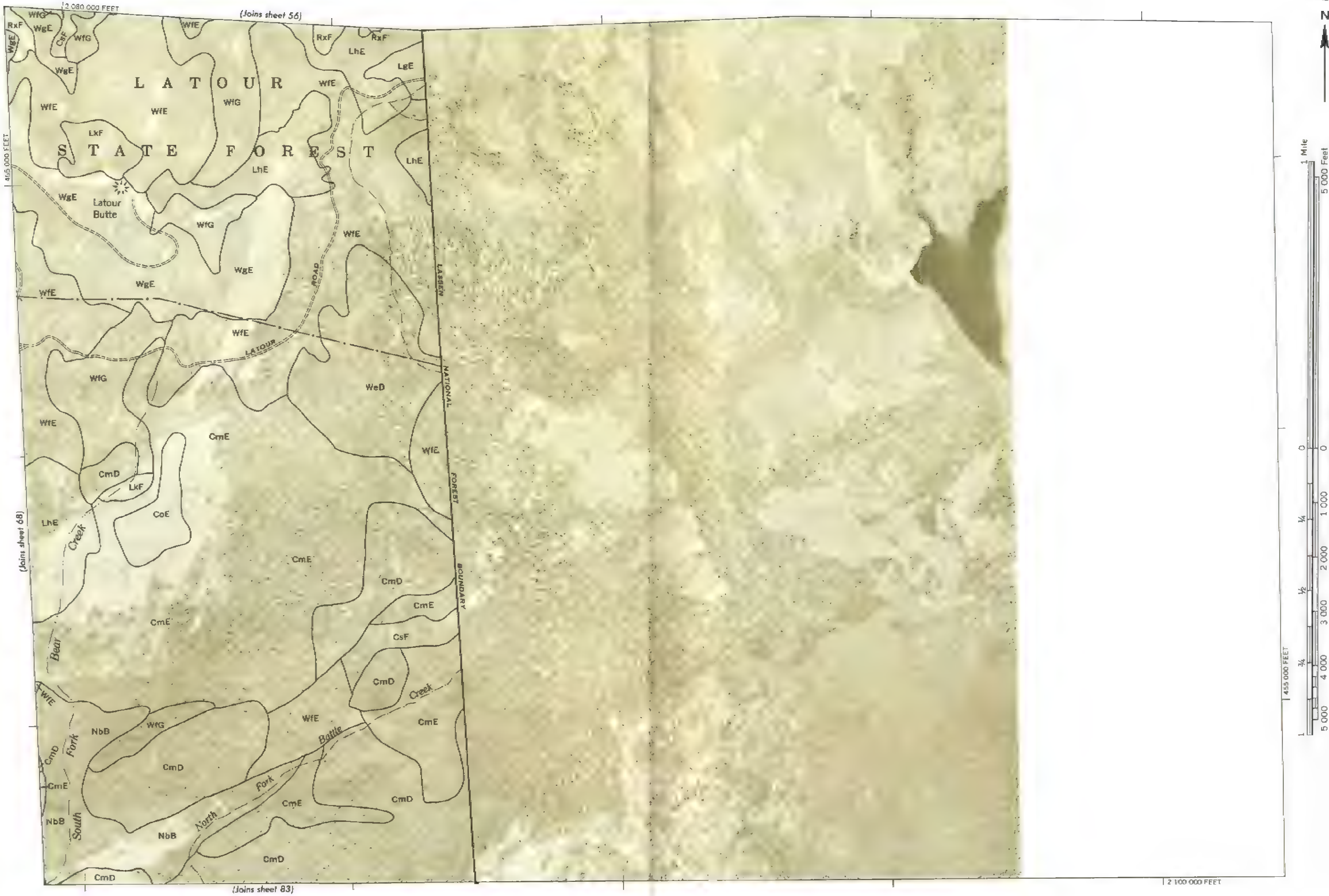

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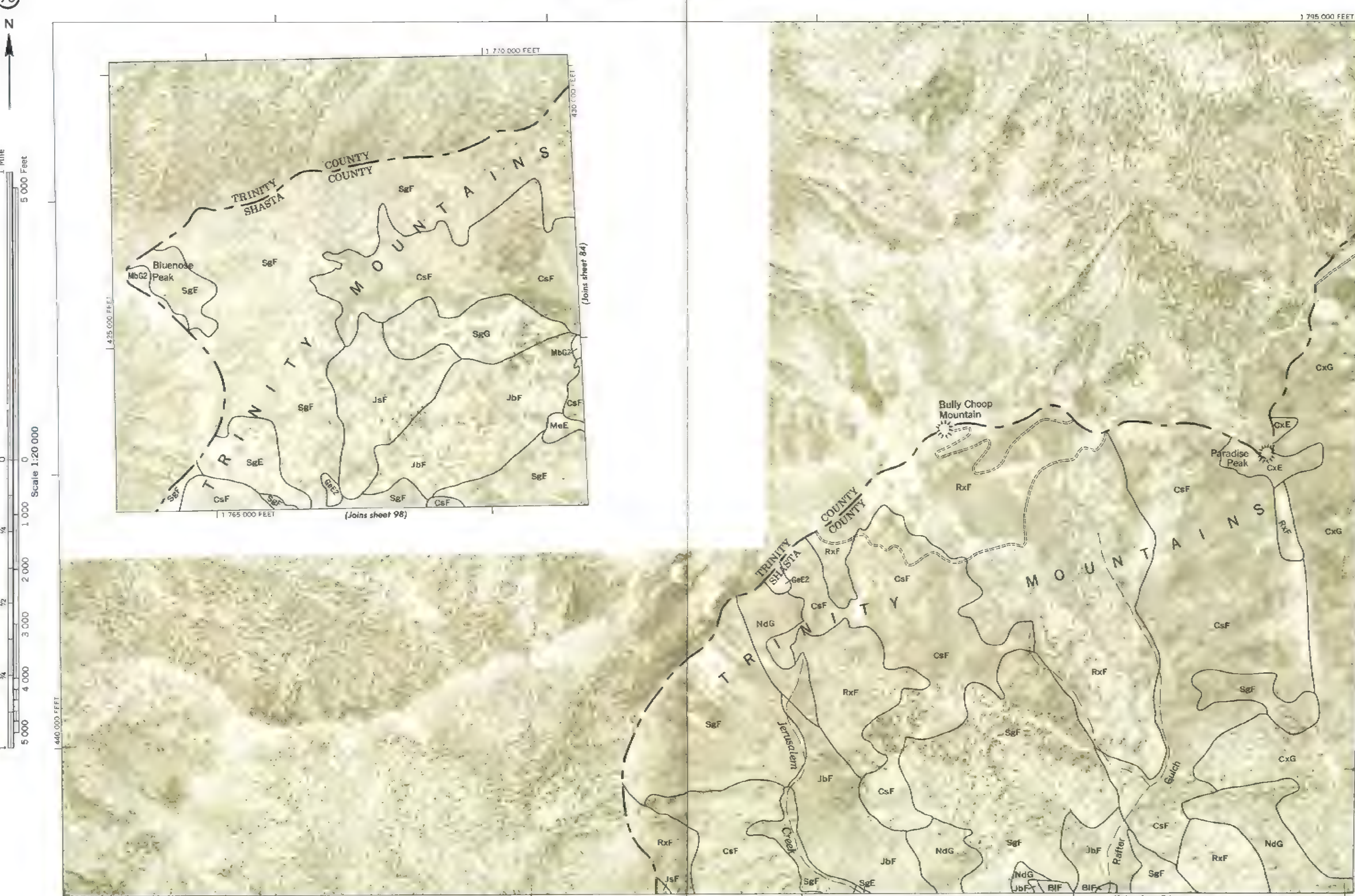
Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.



Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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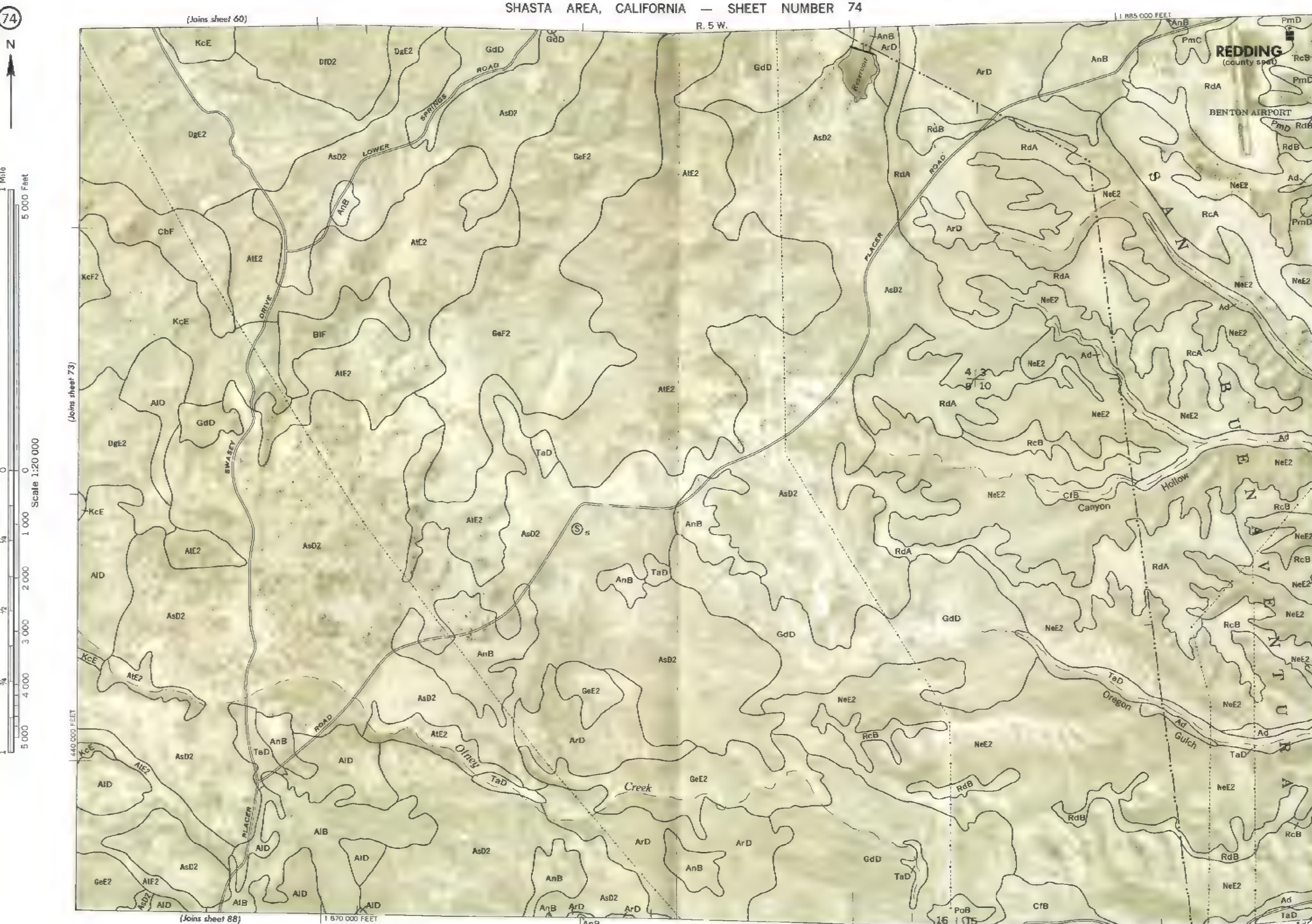
SHASTA AREA, CALIFORNIA NO. 72

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

SHASTA AREA, CALIFORNIA — SHEET NUMBER 74



Land division corners are approximately positioned on this map.
Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.

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Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
Land division corners are approximately positioned on this map.

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Photobase from 1962 and 1968 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
Land division corners are approximately positioned on this map.

SHASTA AREA, CALIFORNIA — SHEET NUMBER 78

Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.

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Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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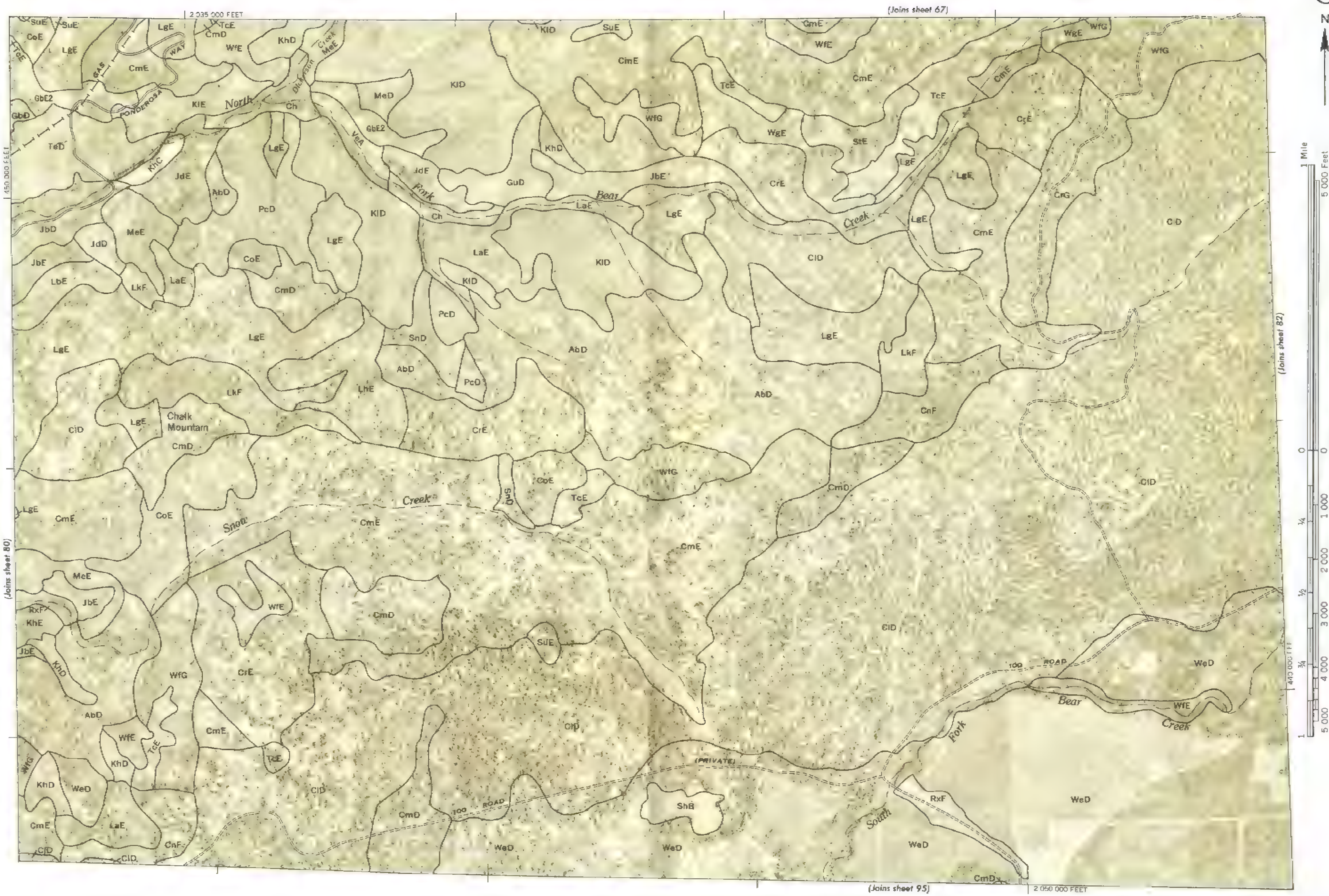

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Photobase from 1952 and 1963 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the California coordinate system, zone 1.

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Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

86

Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
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SHASTA AREA, CALIFORNIA NO. 86

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station
Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1

Land divs on corners are approximately positioned on this map

Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1

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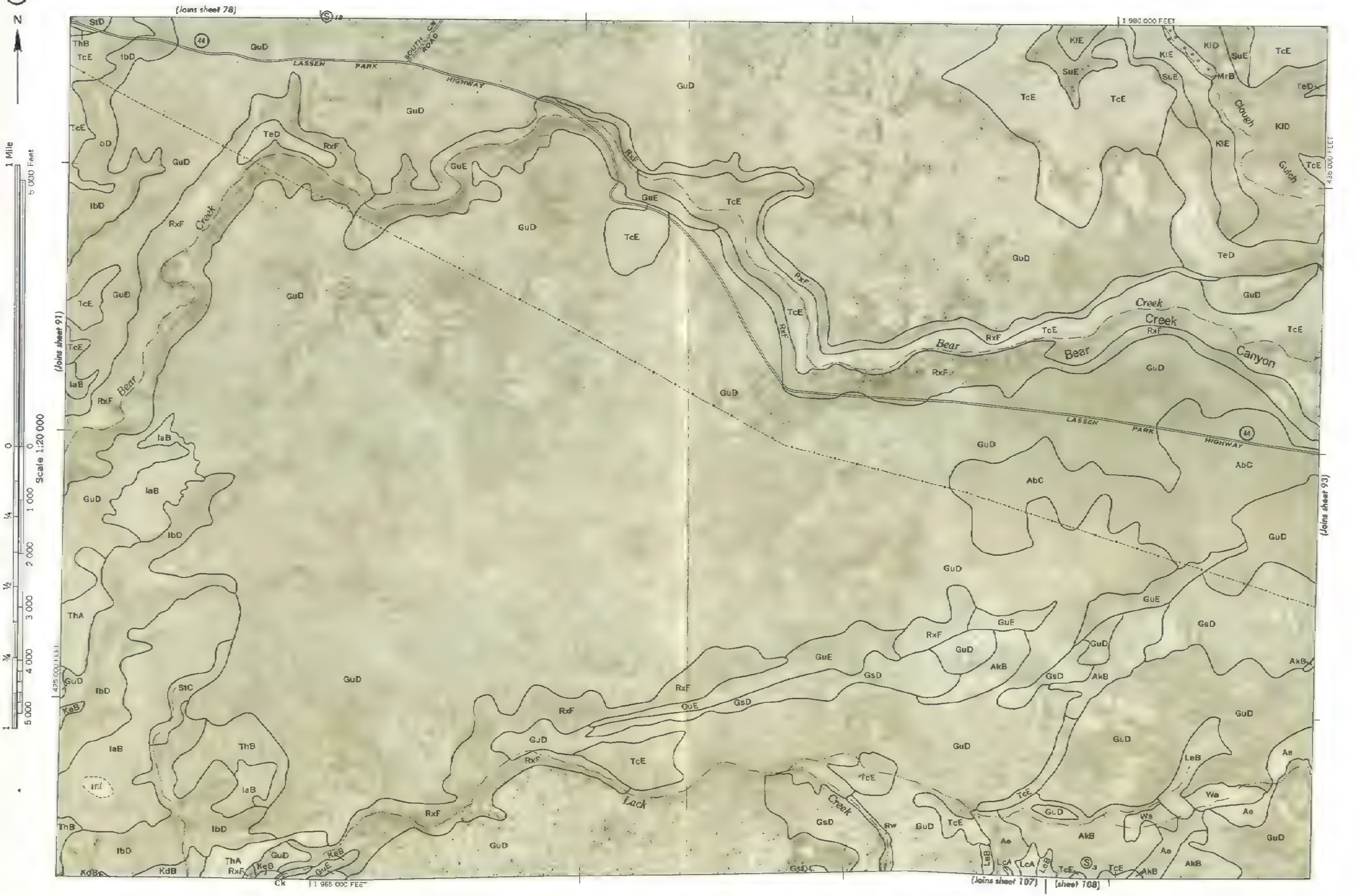
Photobase from 1952 and 1963 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the California coordinate system, zone 1
Land divisions corners are approximately positioned on this map

SHASTA AREA, CALIFORNIA — SHEET NUMBER 90

Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.

SHASTA AREA, CALIFORNIA NO. 91

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
Land division corners are approximately positioned on this map.



Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.

SHASTA AREA, CALIFORNIA NO. 92

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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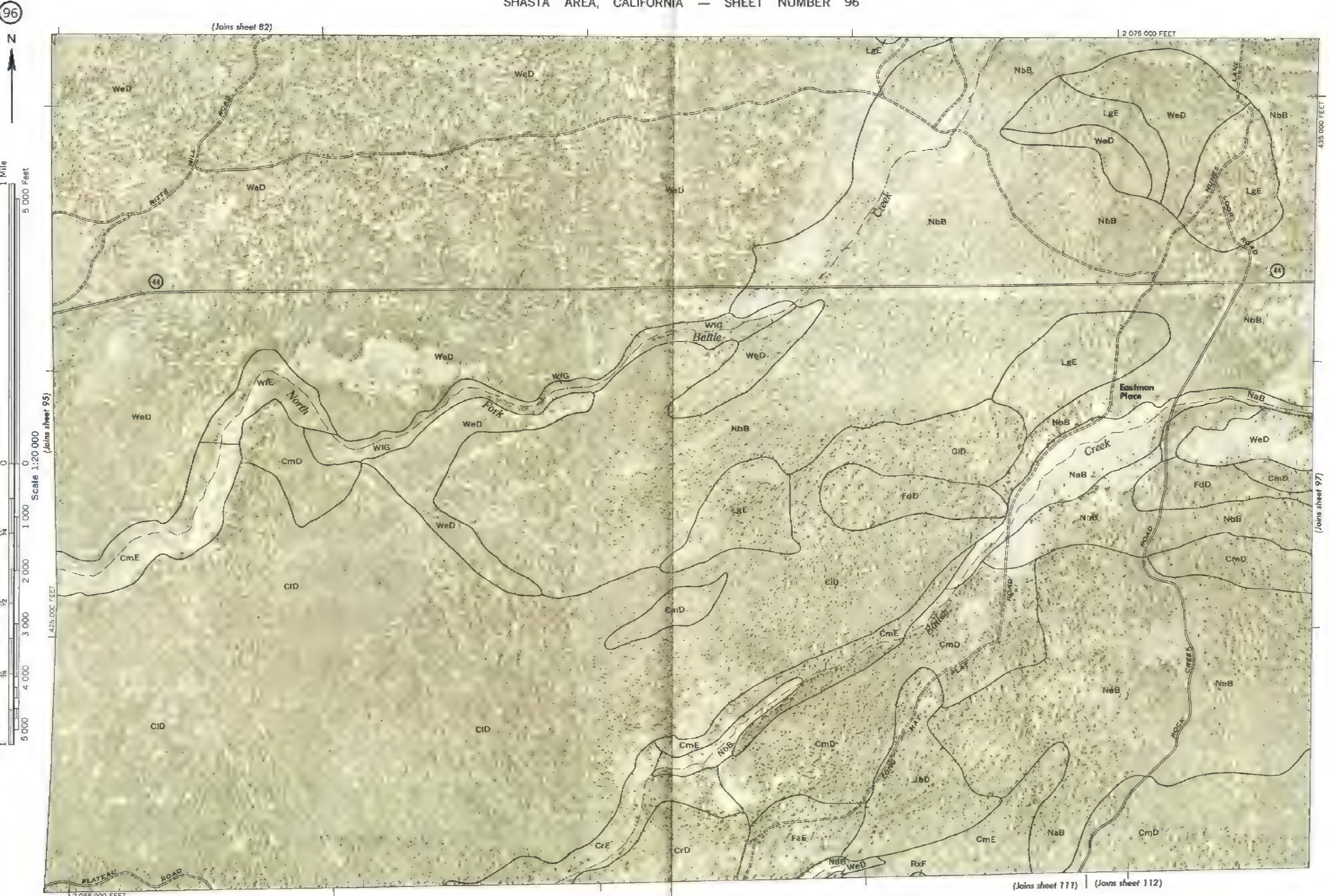
Photobase from 1952 and 1963 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the California coordinate system, zone 1.



Photobase from 1952 and 1953 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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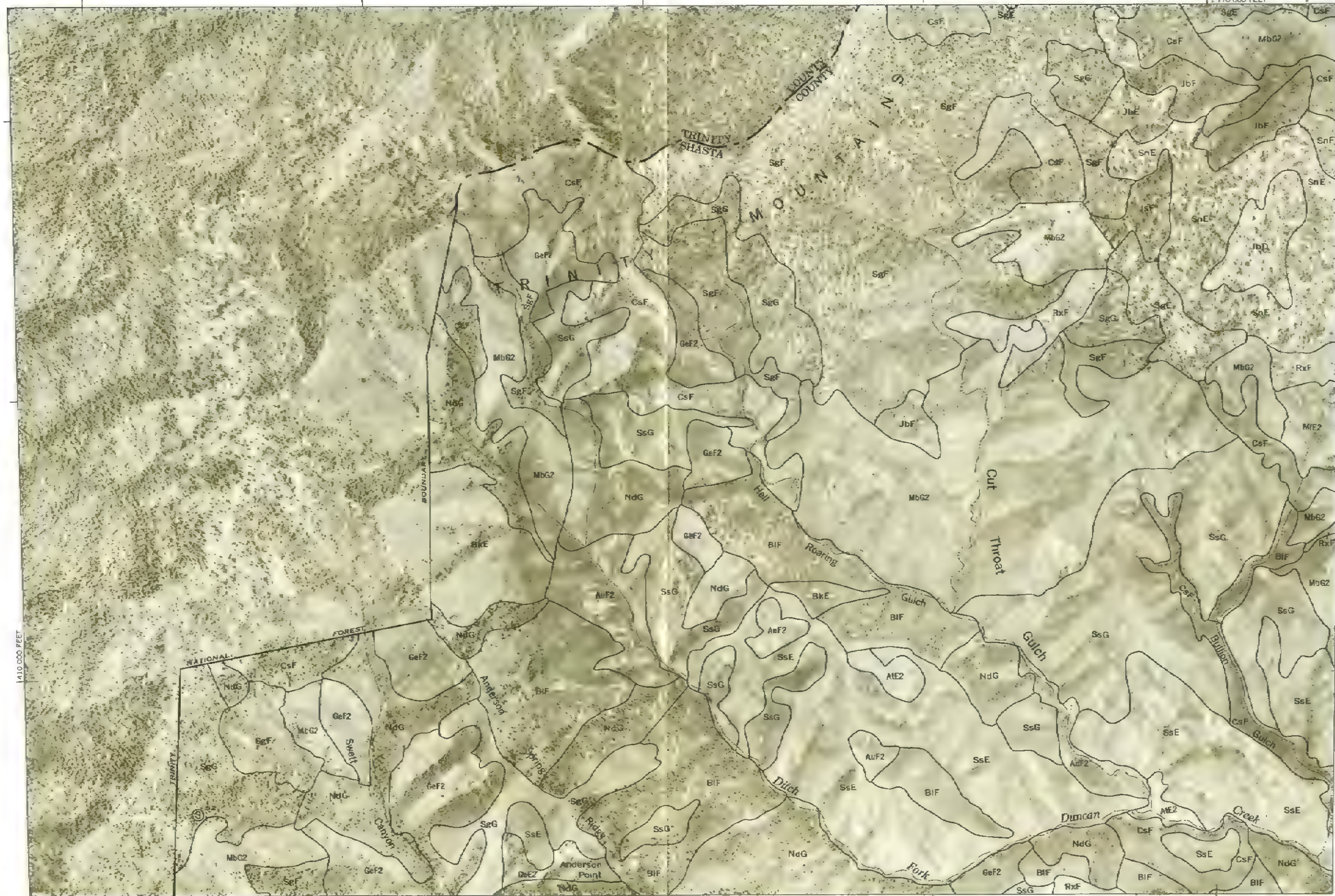
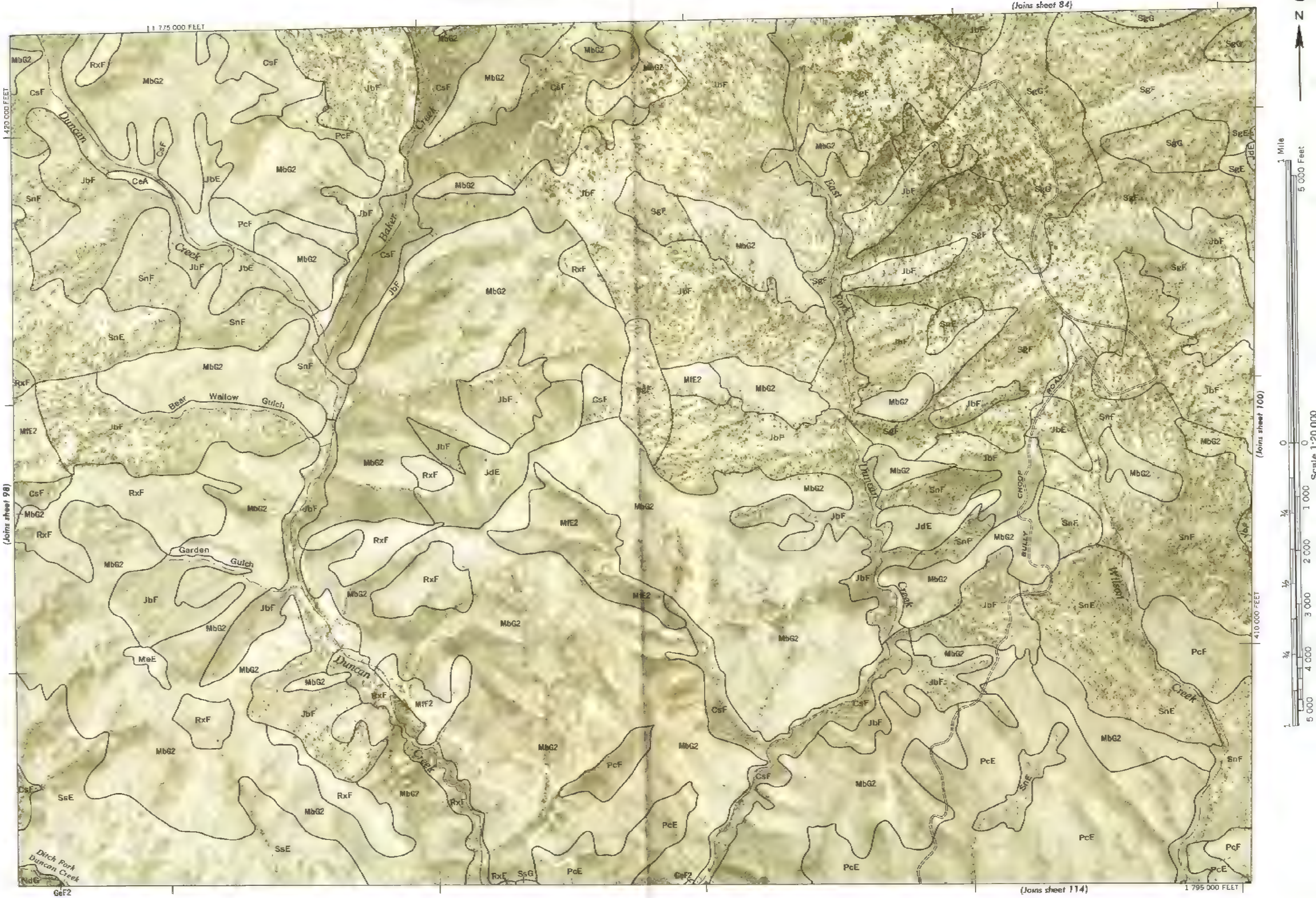


Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1

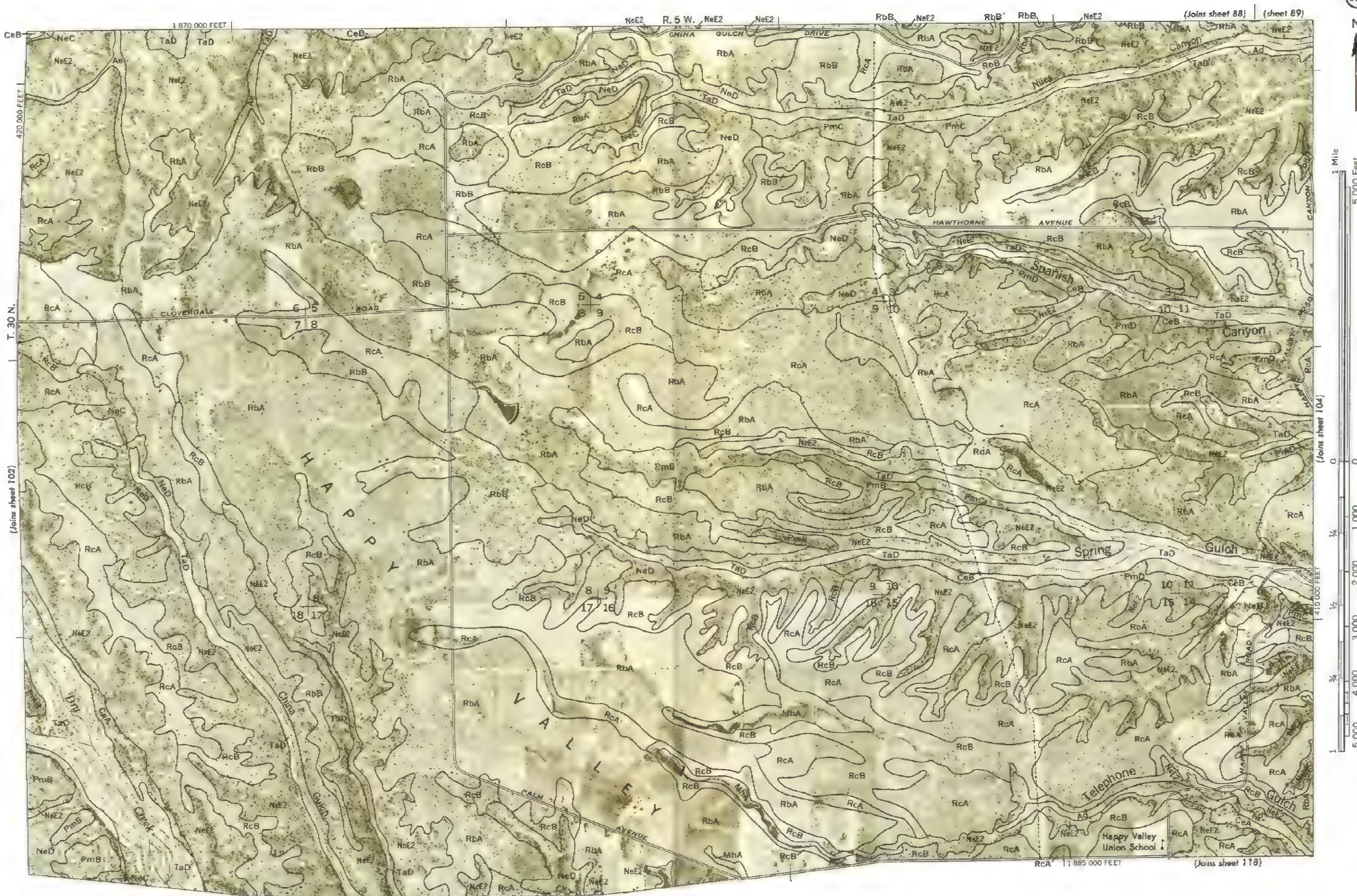
SHASTA AREA, CALIFORNIA NO. 100

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1962 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
Land division corners are approximately positioned on this map.

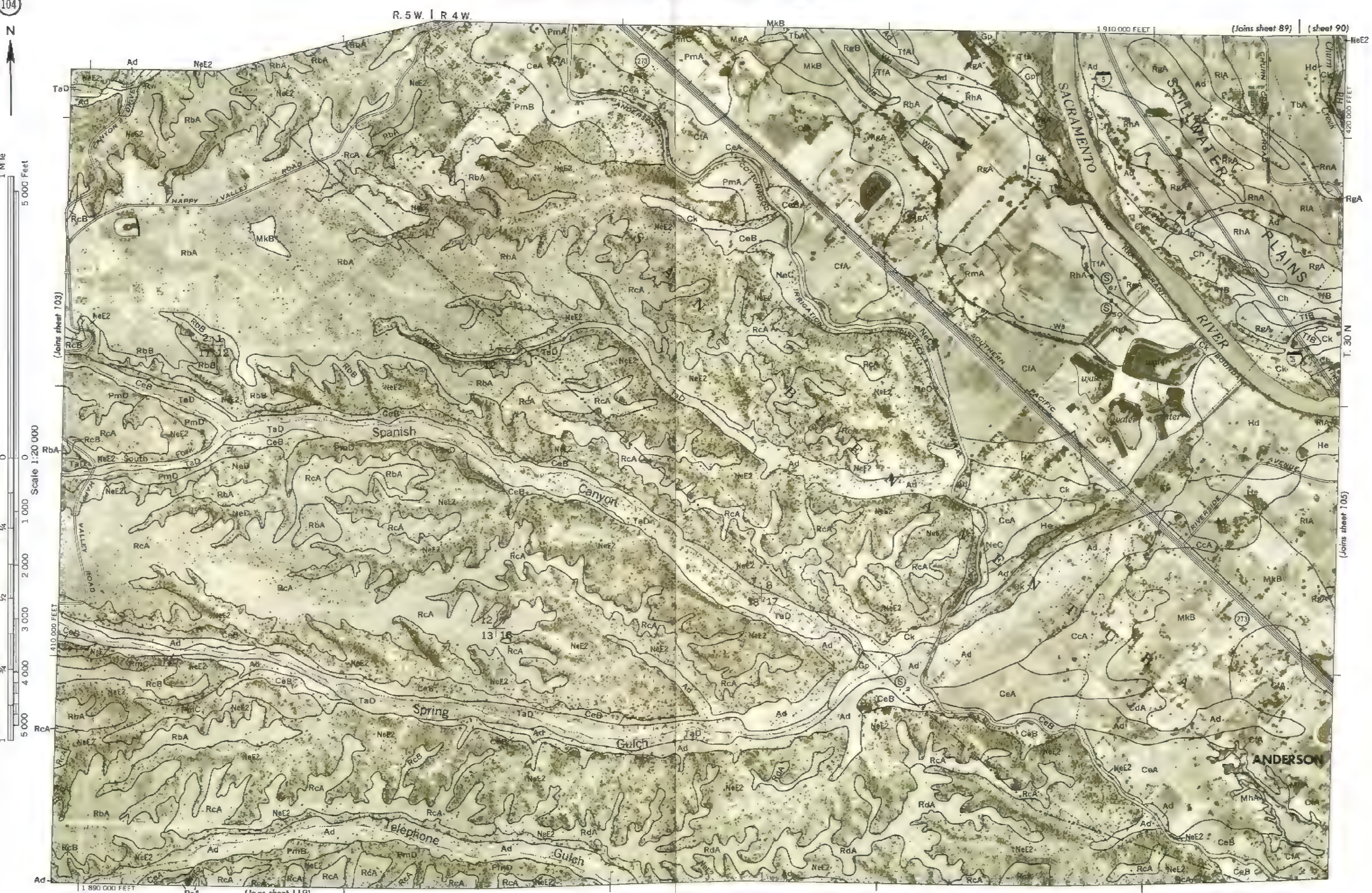
SHASTA AREA, CALIFORNIA — SHEET NUMBER 102

Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.



This map is one of a set compiled in 1972 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, Forest Service, and the University of California Agricultural Experiment Station.
Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
Land division corners are approximately positioned on this map.



Land divisi on corners are approximately positioned on this map.

Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.

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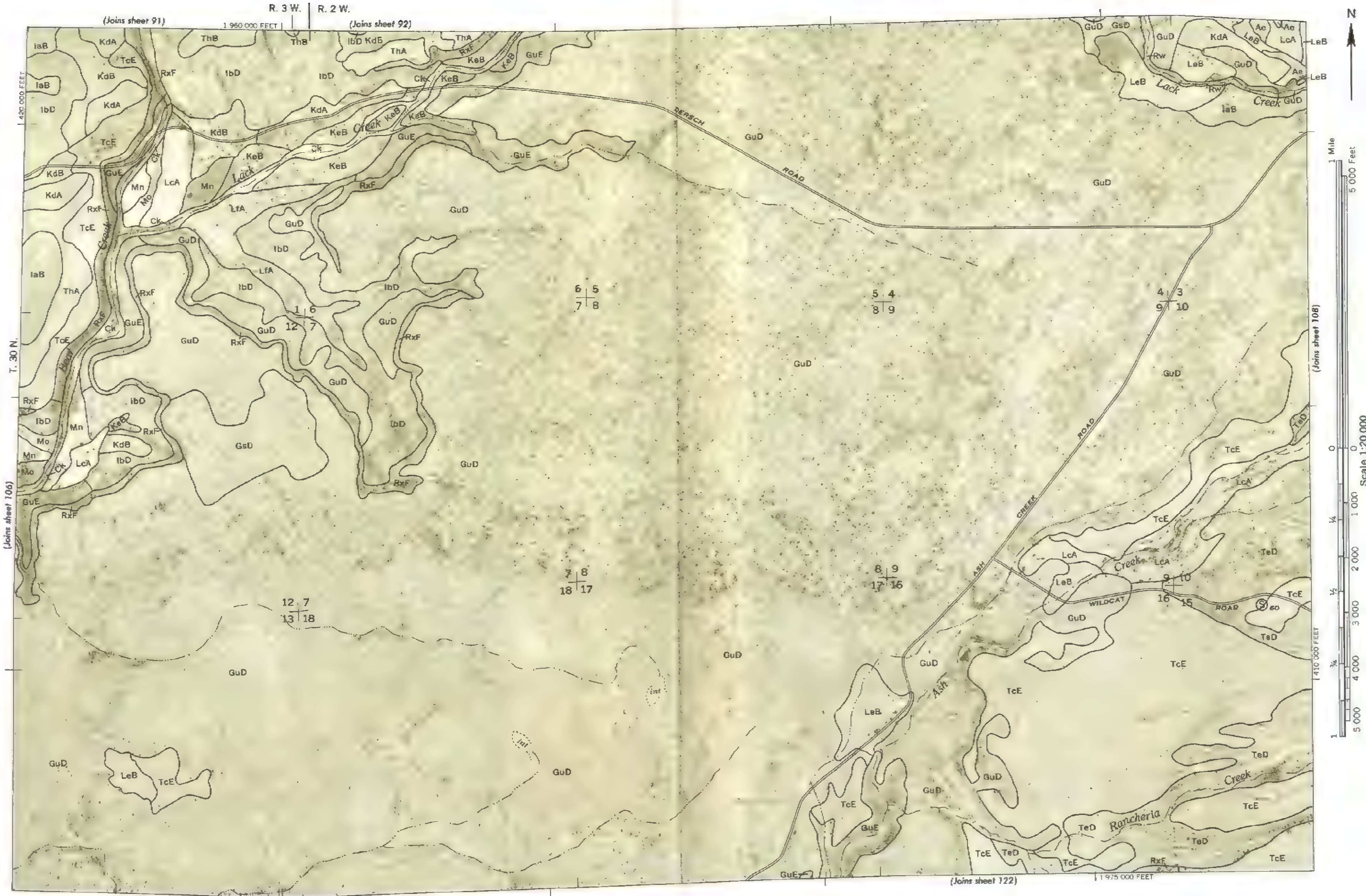

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Photobase from 1952 and 1963 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 1.
Land division corners are approximately positioned on this map.

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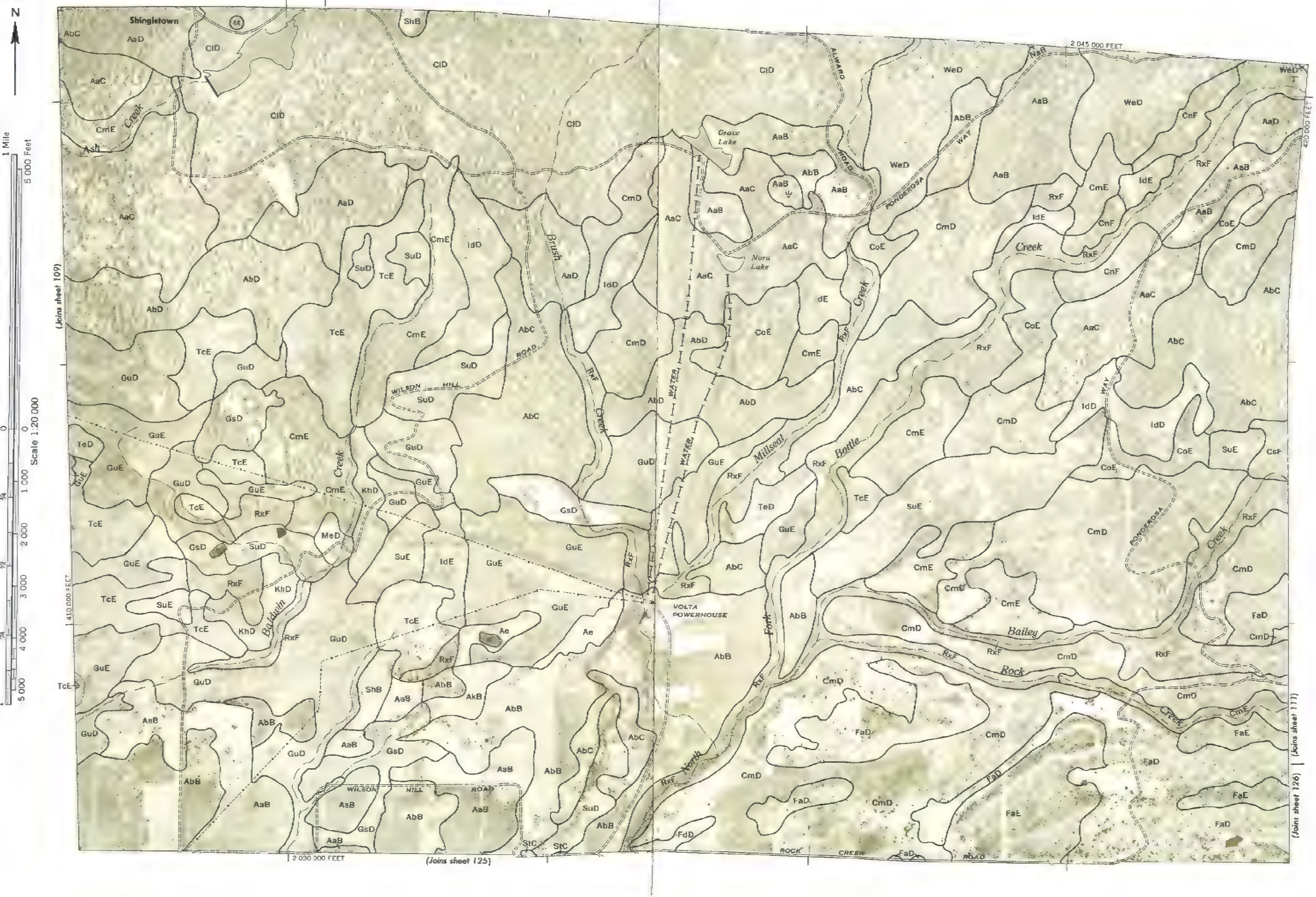

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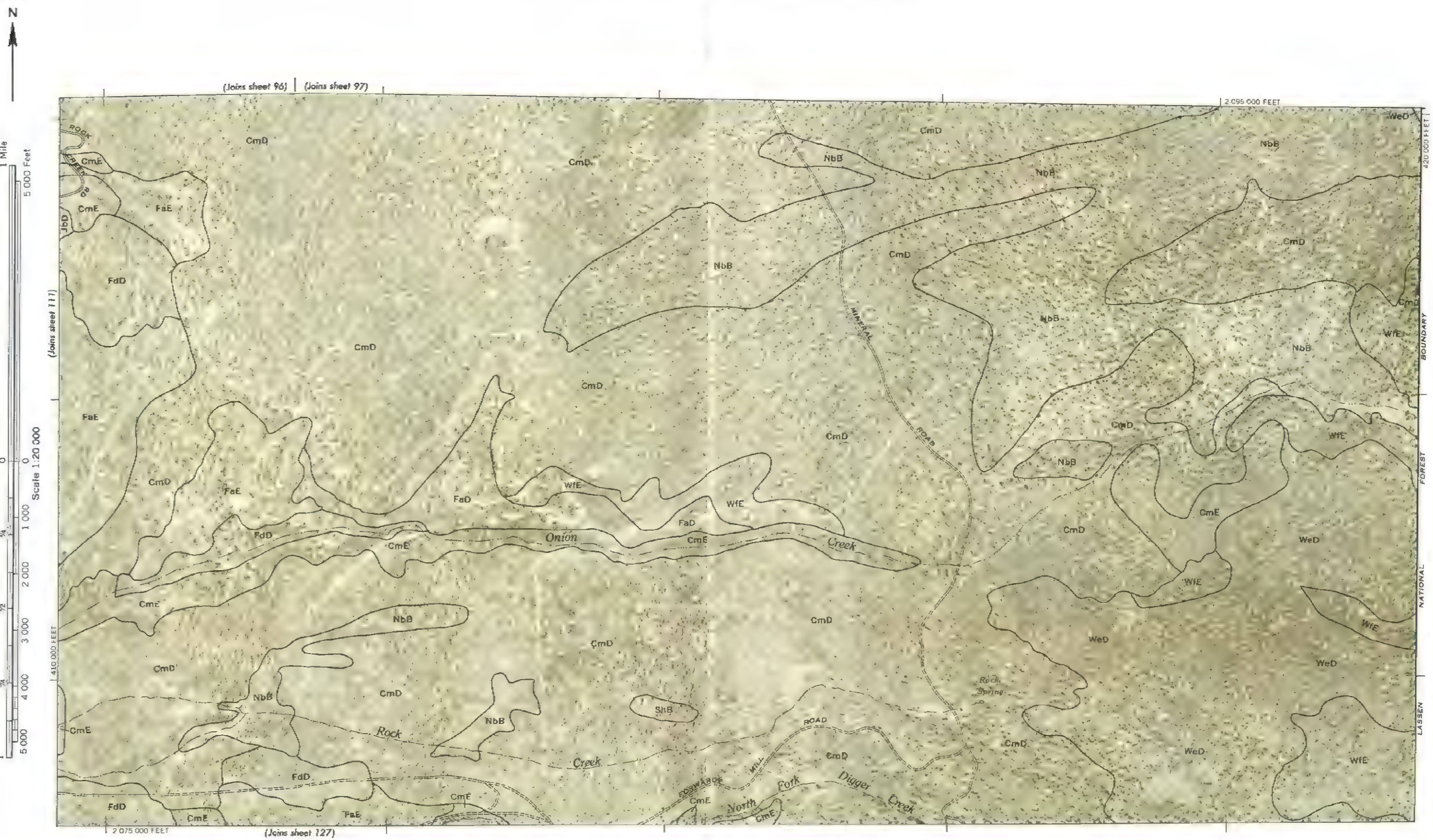
SHASTA AREA, CALIFORNIA — SHEET NUMBER 112



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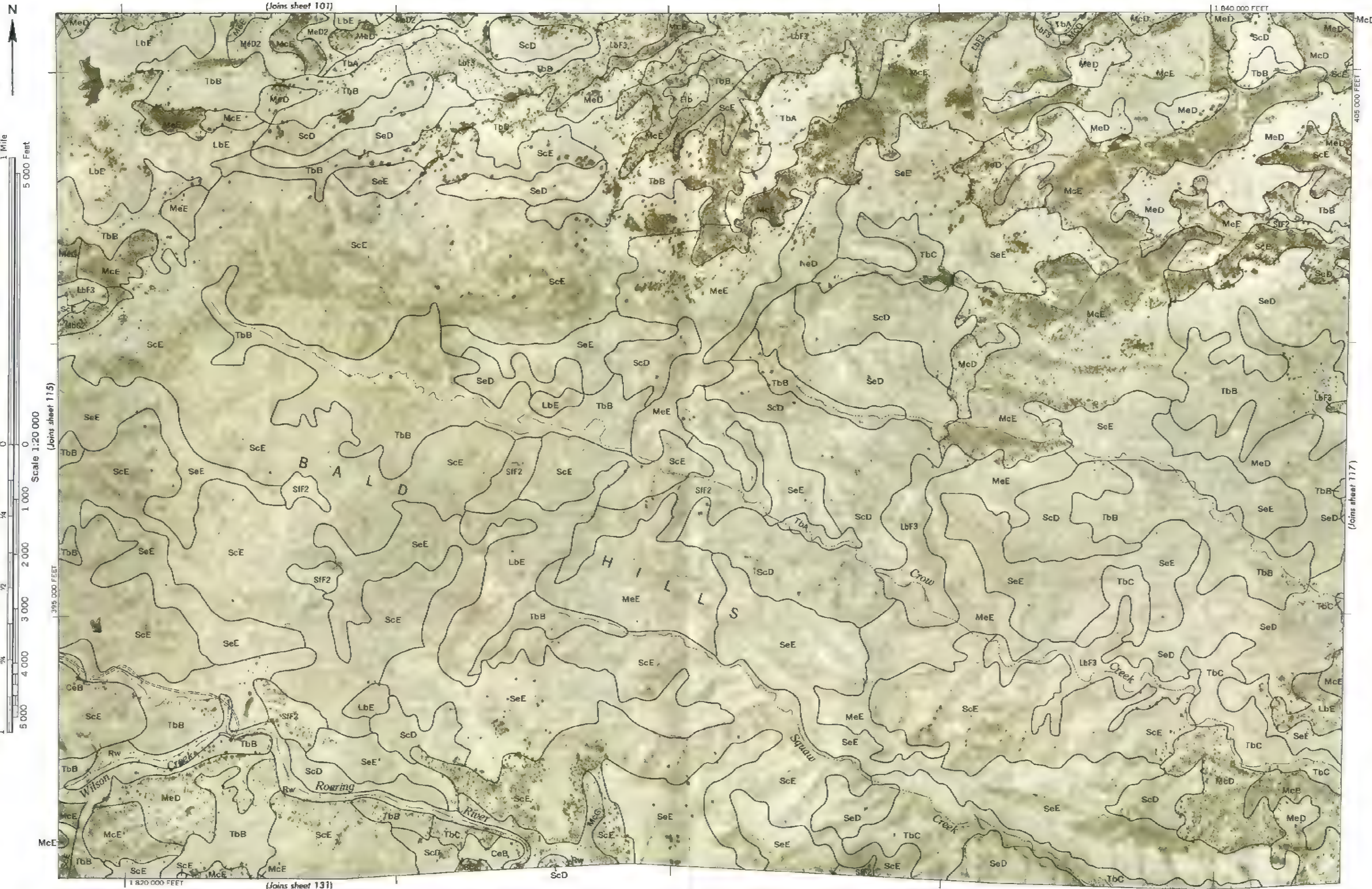

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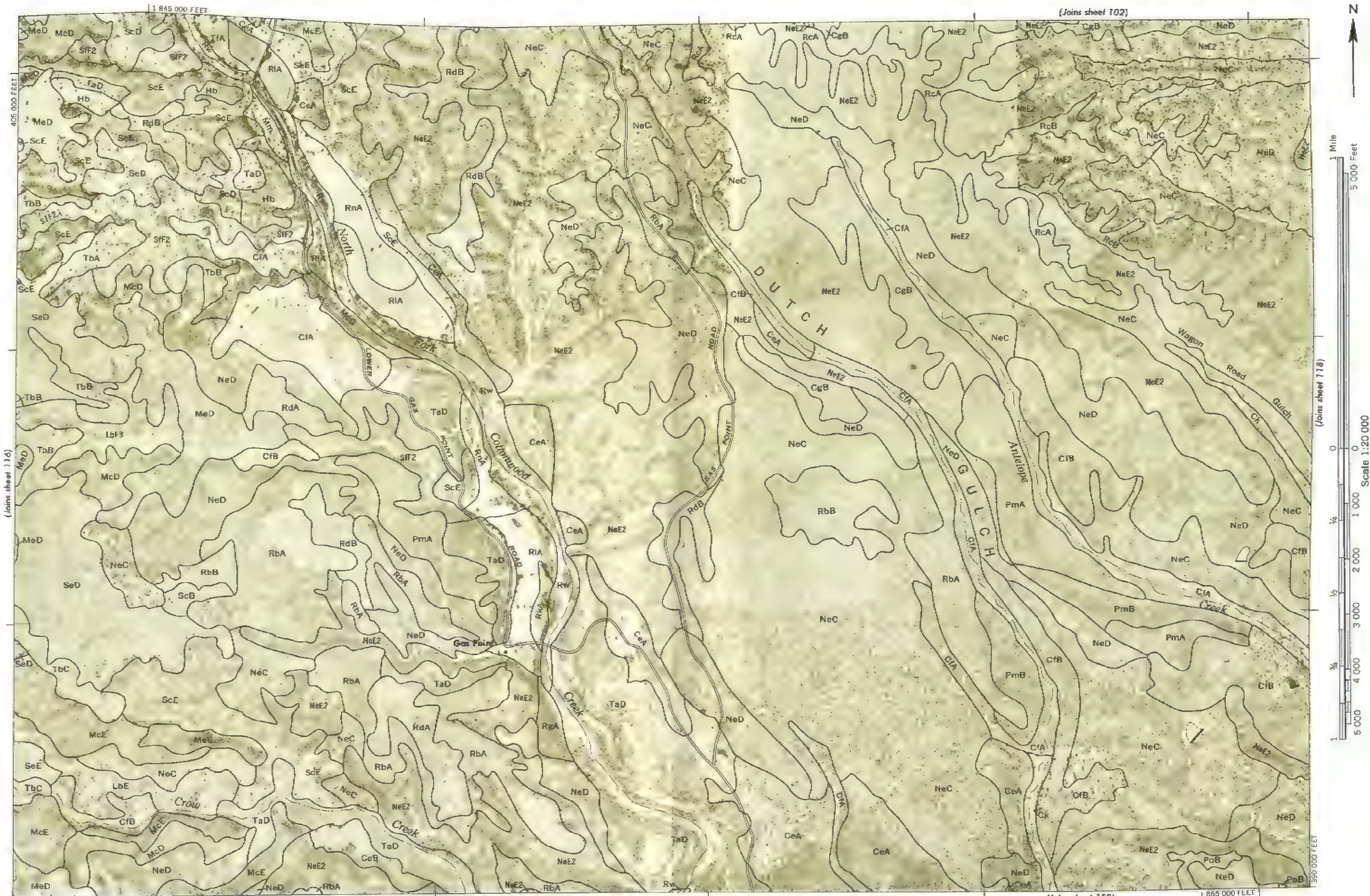

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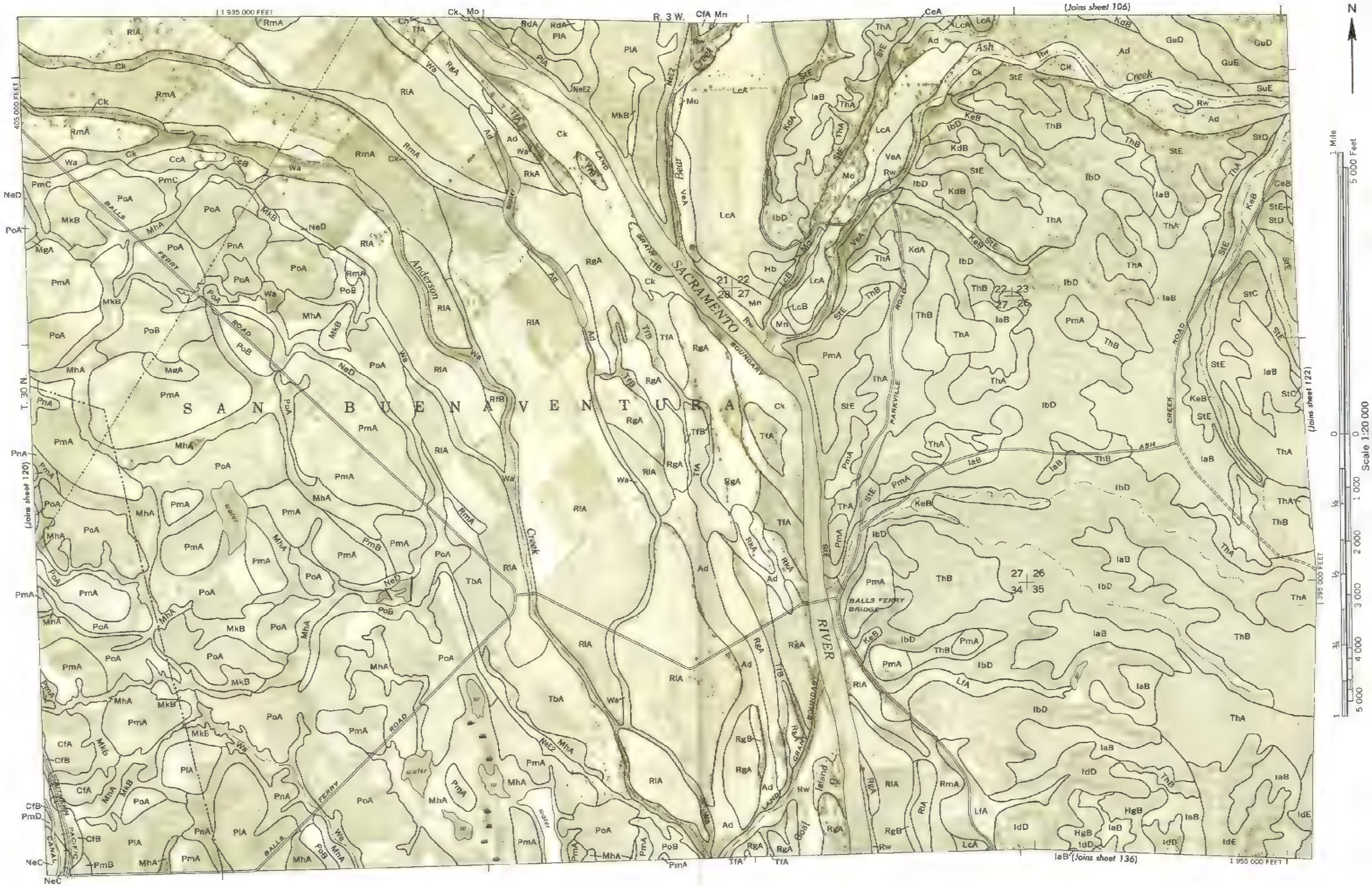

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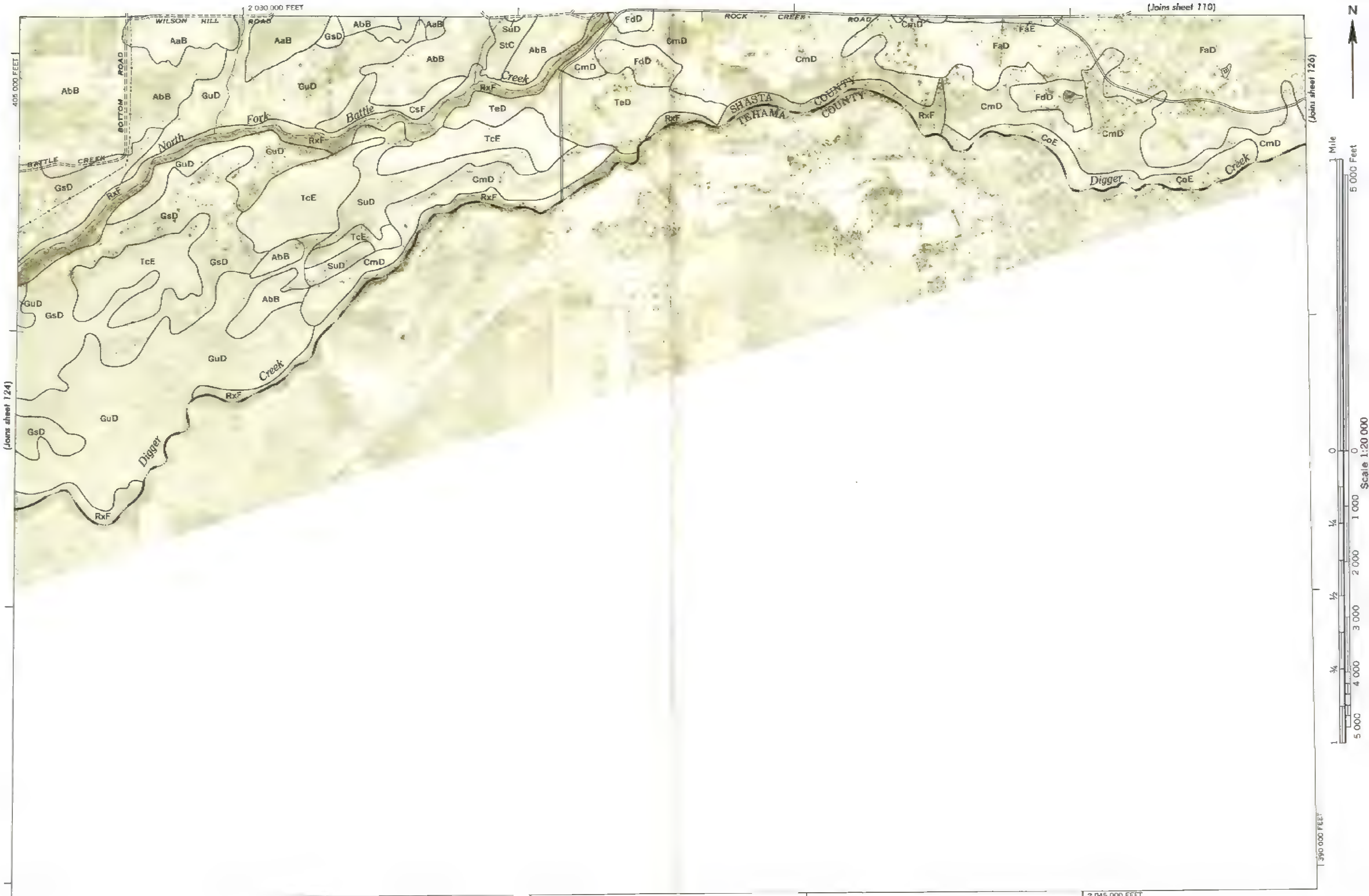

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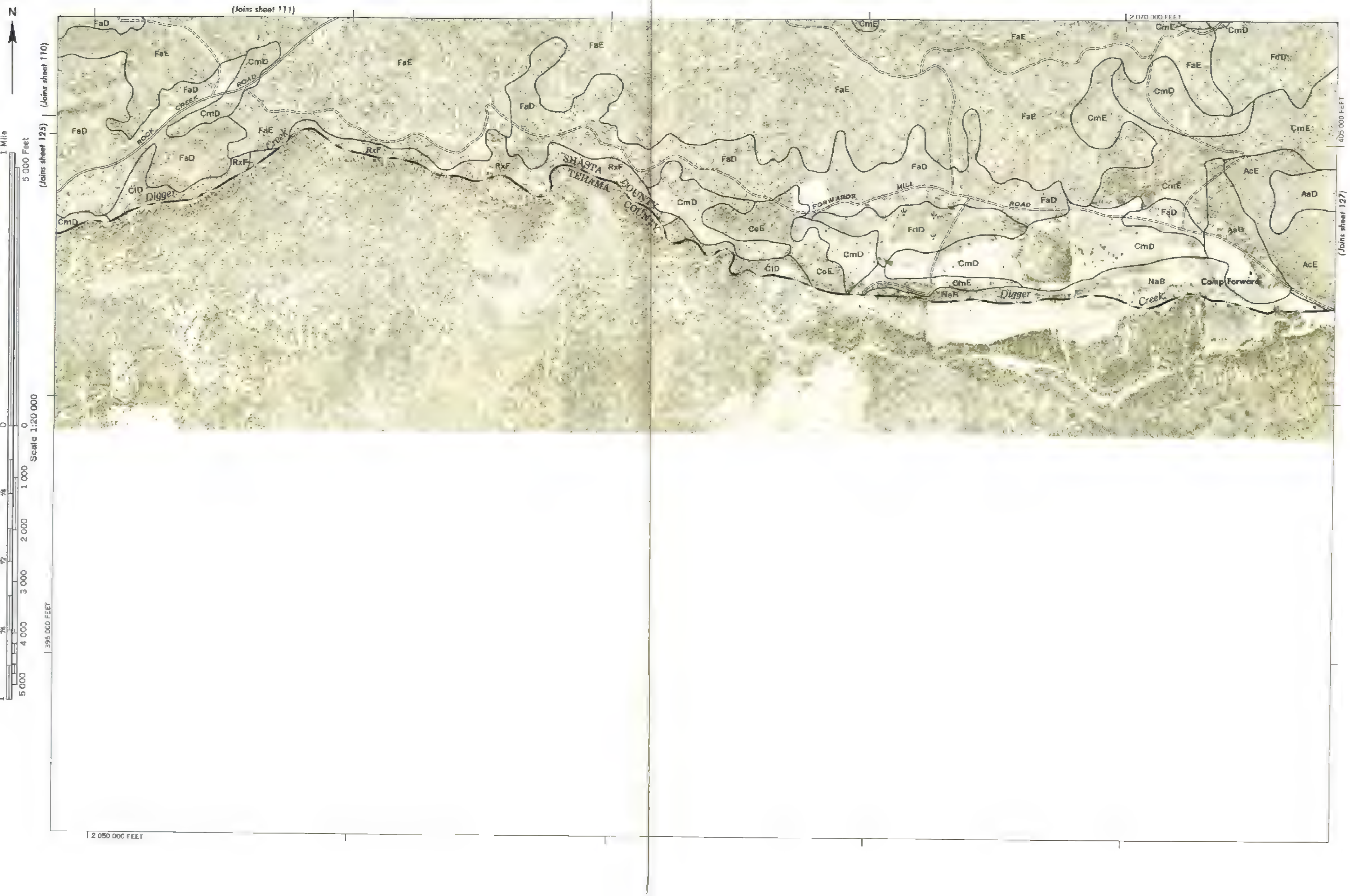

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SHASTA AREA, CALIFORNIA — SHEET NUMBER 128

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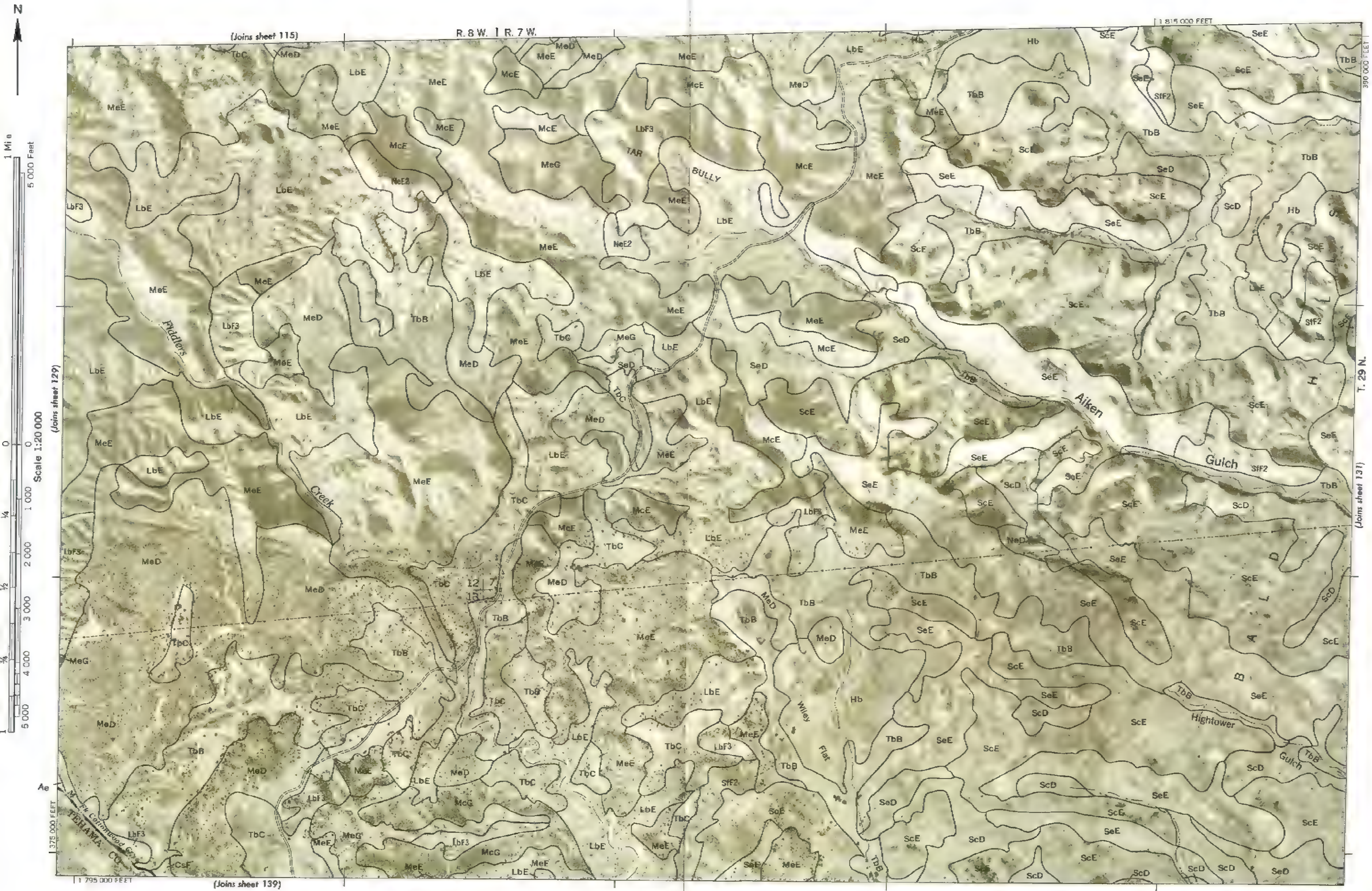

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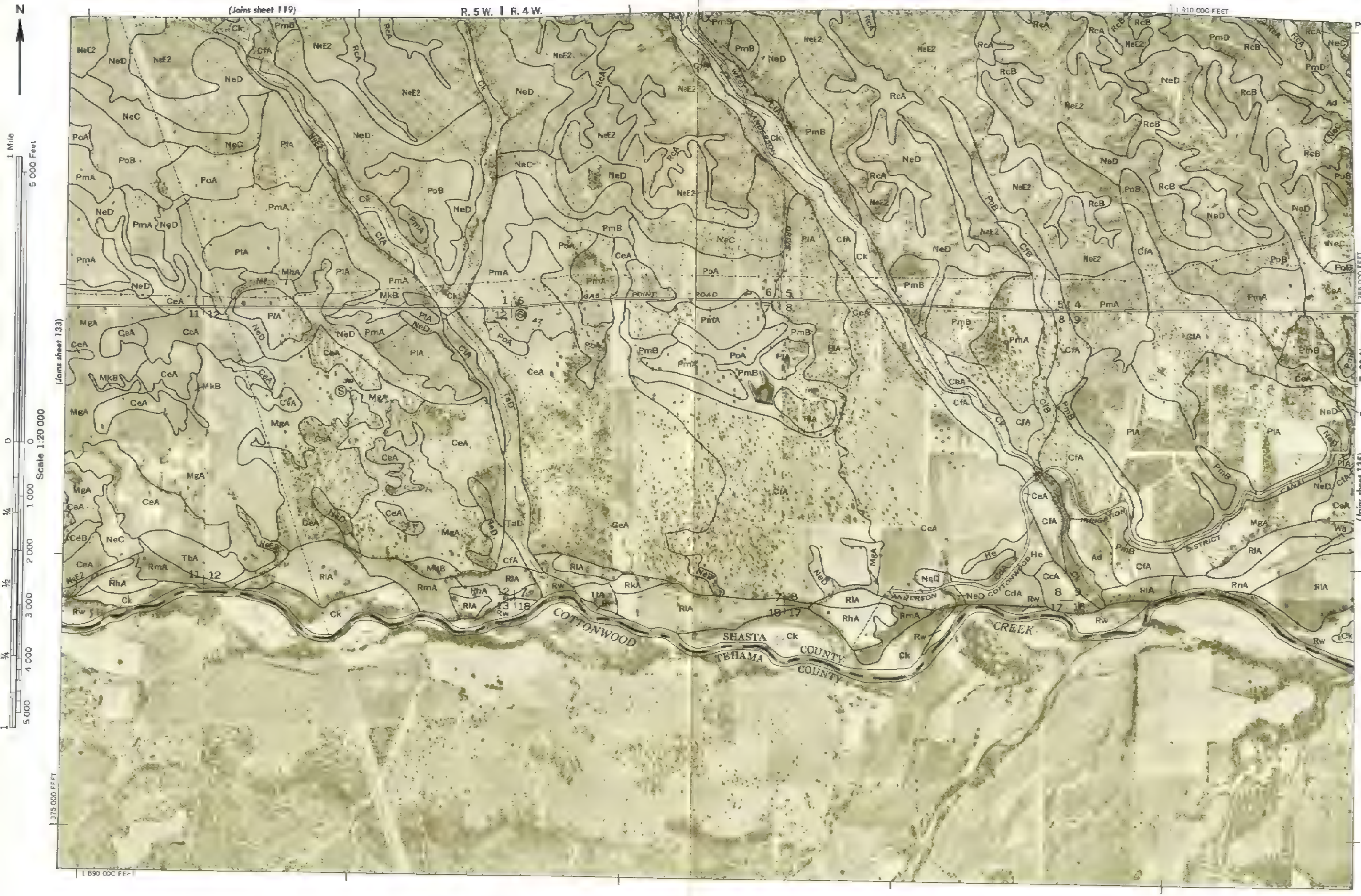

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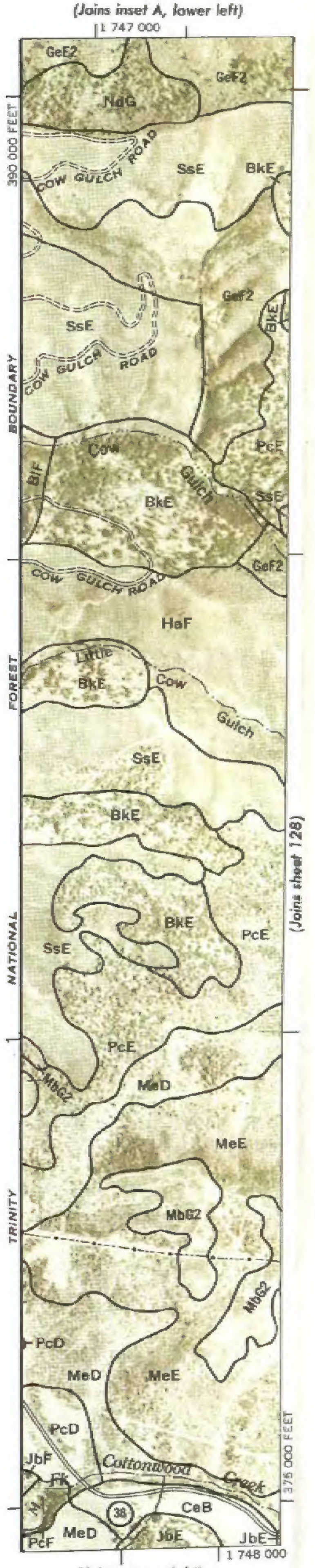
INSET A

(Joins inset B, upper right)

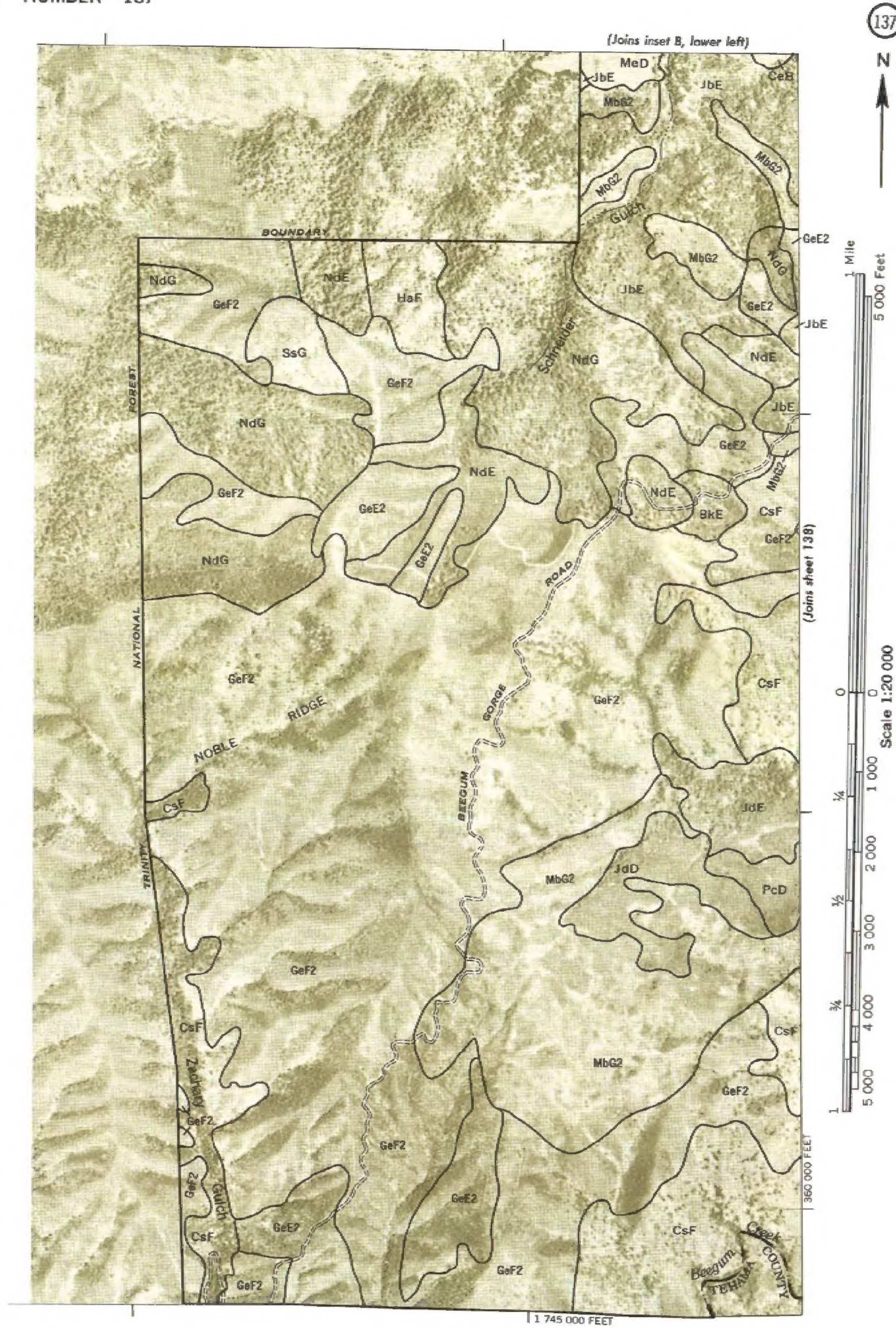
1 000 AND 5 000-FOOT GRID TICKS

(Joins inset A, lower left)



(Joins upper right)

1 000 AND 5 000-FOOT GRID TICKS



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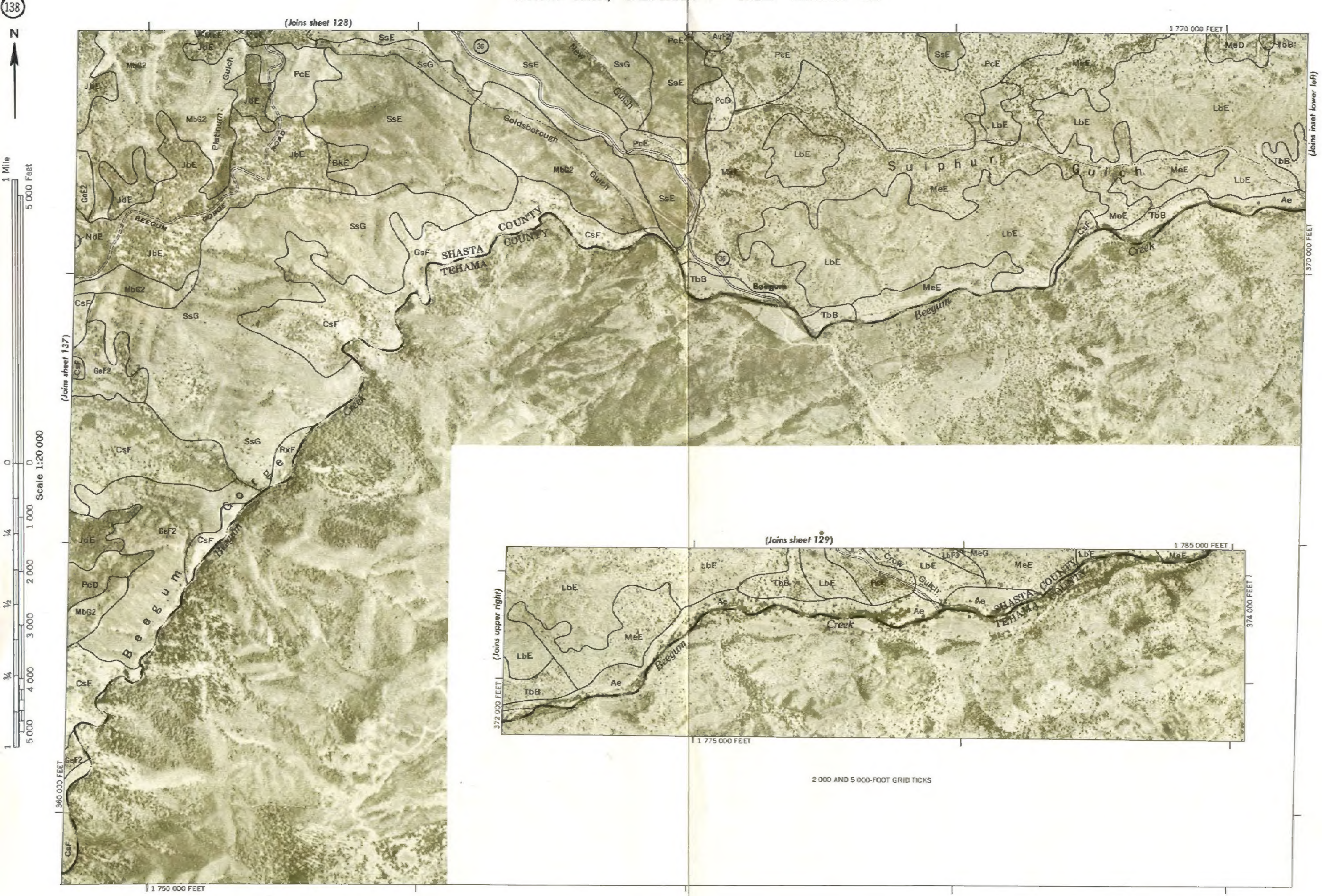

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SHASTA AREA, CALIFORNIA — SHEET NUMBER 140

N

1 Mile

5 000 Feet

Scale 1:20 000

0 | 1/4 | 1/2 | 3/4 | 1 (miles)

0 | 1 000 | 2 000 | 3 000 | 4 000 | 5 000 (feet)

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